Allen-Bradley

CompactLogix System

1769-L31, 1769-L32E, 1769-L35CR, 1769-L35E

User Manual

Rockwell Automation

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.ab.com/manuals/gi) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

Throughout this manual, when necessary we use notes to make you aware of safety considerations.

WARNING Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

IMPORTANT Identifies information that is critical for successful application and understanding of the product.

ATTENTION Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you:

- identify a hazard
- avoid a hazard
- recognize the consequence

SHOCK HAZARD Labels may be located on or inside the equipment (e.g., drive or motor) to alert people that dangerous voltage may be present.

BURN HAZARD Labels may be located on or inside the equipment (e.g., drive or motor) to alert people that surfaces may be dangerous temperatures.

Summary of Changes

This document describes how to use the CompactLogix controller. Changes for this version are marked by change bars in the margin, as shown to the right.

The most significant change to this manual is the inclusion of the 1769-L35CR CompactLogix controller. Table Summary of Changes.1 describes the major changes in this version.

Table Summary of Changes.1

In this section:	This information was added:
Chapter 1	Basic description of the 1769-L35CR CompactLogix controller
Chapter 4	Communicating with Devices on a ControlNet Link Via the 1769-L35CR CompactLogix controller
Appendix A	1769-L35CR specifications and dimensions
Appendix B	Description of ControlNet LEDs

Other changes have been made throughout this manual and, although not significant enough to warrent mention in the table above, they are marked by change bars.

Notes:

Who Should Use This Manual

Read this preface to familiarize yourself with the rest of the manual. This preface covers the following topics:

- who should use this manual
- how to use this manual
- related publications
- conventions used in this manual
- Rockwell Automation support

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use Allen-Bradley CompactLogix™ controllers.

How to Use This Manual

As much as possible, we organized this manual to explain, in a task-by-task manner, how to install, configure, program, operate and troubleshoot a CompactLogix control system.

Related Documentation

The core documents listed in Table Preface.1 address the Logix5000 family of controllers:

Table Preface.1

If you are:	Use this publication:
a new user of a Logix5000 controller This quick start provides a visual, step-by-step overview of the basic steps you need to complete to get your controller configured and running.	Logix5000 Controllers Quick Start publication 1756-QS001
an experienced user of Logix5000 controllers This system reference provides a high-level listing of configuration information, controller features, and instructions (ladder relay, function block diagram, and structured text).	Logix5000 Controllers System Reference publication 1756-QR107
any user of a Logix5000 controller This common procedures manual explains the common features and functions of all Logix5000 controllers.	Logix5000 Controllers Common Procedures publication 1756-PM001

CompactLogix-specific information is also available:

For	Read this document	Document number
Information on installing a 1769-L31 CompactLogix controller	1769-L31 CompactLogix Controller Installation Instructions	1769-IN069
Information on installing a 1769-L32E, -L35E CompactLogix controller	1769-L32E, -L35E CompactLogix Controller Installation Instructions	1769-IN020
Information on installing a 1769-L35CR CompactLogix controller	1769-L35CR CompactLogix Controller Installation Instructions	1769-IN070
Information on how to use ControlNet modules, including the 1769-L35CR CompactLogix controller, for common Logix5000 control system functions	ControlNet Modules in Logix5000 Control Systems User Manual	CNET-UM001
Information on the CompactLogix Instruction Set	Logix5000 Controllers General Instruction Set Reference Manual	1756-RM003
Information on function block programming Logix controllers.	Logix5000 Controllers Process Control/Drives Instruction Set Reference Manual	1756-RM006
Execution times and memory use for instructions	Logix5000 Controllers Execution Time and Memory Use Reference Manual	1756-RM087
Information on installing, configuring, and using Compact Analog I/O modules	Compact I/O Analog Modules User Manual	1769-UM002
Information on using the 1769-ADN DeviceNet adapter	Compact I/O 1769-ADN DeviceNet Adapter User Manual	1769-UM001
Information on using the 1769-SDN DeviceNet scanner	Compact I/O 1769-SDN DeviceNet Scanner Module User Manual	1769-UM009
Information on grounding and wiring Allen-Bradley programmable controllers.	Allen-Bradley Programmable Controller Grounding and Wiring Guidelines	1770-4.1

To view manuals, visit www.rockwellautomation.com/literature. To purchase a manual, contact your local Rockwell Automation distributor or sales representative.

Conventions Used in This Manual

The following conventions are used throughout this manual:

- Bulleted lists (like this one) provide information not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.
- *Italic* type is used for emphasis.

Chapter 1
What Is CompactLogix?

Chapter 2
Placing, Configuring, and Monitoring Local I/O

Chapter 3

Communicating with Devices on an EtherNet/IP Network

Chapter 4

Communicating with Devices on a ControlNet Link

Chapter 5

Communicating with Devices on a DeviceNet link

Chapter 6

Communicating with Devices on a Serial Link

Chapter 7

Communicating with Devices on a DH-485 Link

Appendix A

CompactLogix System Specifications

Appendix B

CompactLogix System Status Indicators

EtherNet/IP Diagnostics

Appendix C

Dynamic Memory Allocation in CompactLogix Controllers

Appendix D

Index

What Is CompactLogix?

Using This Chapter

Use this chapter to gain a basic understanding of what a your CompactLogix controller is.

Table 1.1

Using the Right Controller

The CompactLogix controller, part of the Logix family of controllers, provides a small, powerful, cost-effective system built on the following components:

- The CompactLogix controller is available in different combinations of communication options, user memory, tasks supported and I/O supported. Each of these controllers supports use of the CompactFlash card for nonvolatile memory.

Table 1.2

Controller:	Available memory:	Communication options:	Number of tasks supported:	Number of local I/O modules supported:
1769-L35CR	1.5 Mbytes	1 port ControlNet - supports redundant media 1 port RS-232 serial (system or user protocols)	8	30
1769-L35E		1 port EtherNet/IP 1 port RS-232 serial (system or user protocols)		
1769-L32E	750 Kbytes	1 port EtherNet/IP 1 port RS-232 serial (system or user protocols)	6	16
1769-L31	512 Kbytes	1 port RS-232 serial (system or user protocols) 1 port RS-232 serial (system protocol only)	4	

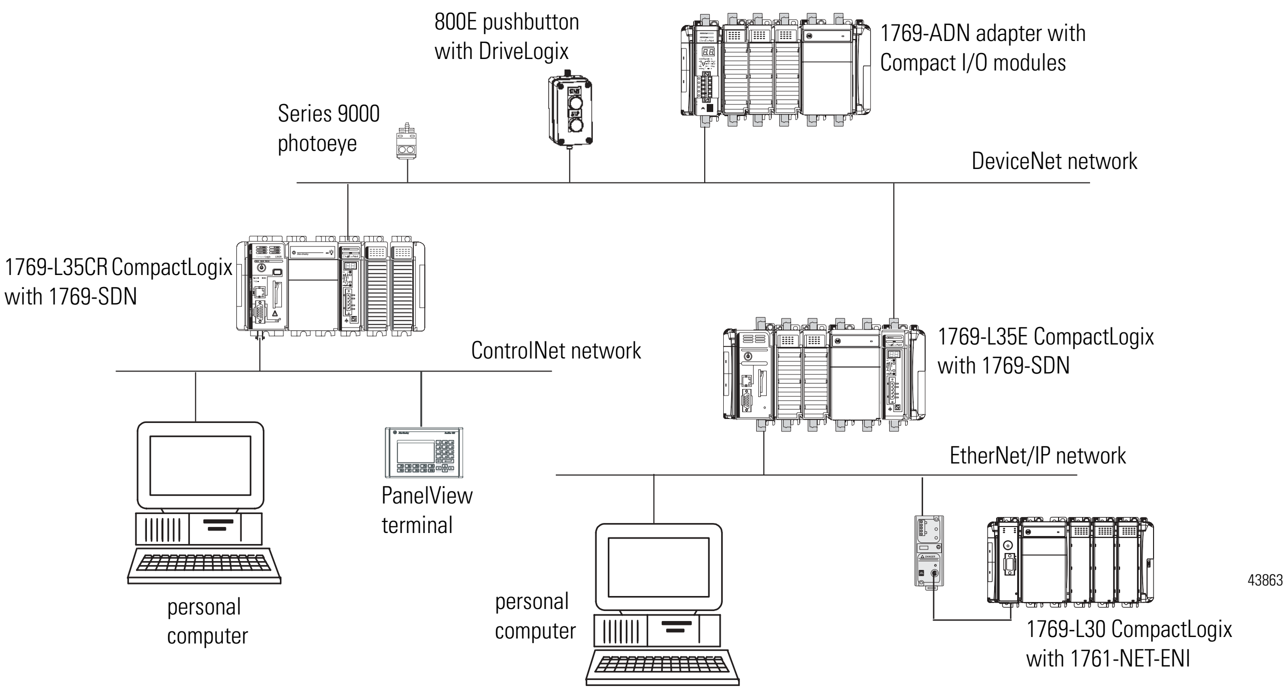
- RSLogix 5000 programming software supports every Logix controller.

- Compact I/O modules provide a compact, DIN-rail or panel-mounted I/O system.

IMPORTANT	When mounting the CompactLogix system, either use screws to panel mount system OR use DIN rail. Do NOT use both. Use of both mounting methods may cause the system to fail.

- The 1769-SDN communication interface module provides I/O control and remote device configuration over DeviceNet.

Figure 1.1



The newer 1769-L3xx controllers (i.e., 1769-L35CR, 1769-L35E, 1769-L32E, and 1769-L31) offer significant performance and capacity improvements over the 1769-L20 and 1769-L30 controllers. These 1769-L3xx controllers are designed for mid-range applications. They offer:

- increased user memory up to 1.5 Mbytes
- as many as 8 tasks (1769-L20, -L30 controllers support 4 tasks)
- CompactFlash for non-volatile memory storage
- extended I/O capacity up to 30 I/O modules
- increased backplane capacity and throughput resulting in the ability to mix and match any combination of digital, analog, and specialty I/O modules
- backplane messaging support
- integrated ControlNet support (1769-L35CR only), including control of distributed I/O
- redundant ControlNet media (1769-L35CR only) that allows the controller to send signals on two separate ControlNet segments. In this case, the receiving node compares the quality of the two signals and accepts the better signal to permit use of the best signal; redundancy also provides a backup cable should one cable fail.
- integrated EtherNet/IP support (1769-L35E and 1769-L32E only), including control of distributed I/O
- increased I/O performance allows 1ms backplane requested packet interval (RPI) under certain conditions

Loading Controller Firmware

The controller ships without working firmware. You must download the current firmware before you can use the controller. To load firmware, you can use:

- ControlFlash utility that ships with RSLogix 5000 programming software.
- AutoFlash that launches through RSLogix 5000 software when you download a project to a controller that does not have the current firmware.
- a 1784-CF64 CompactFlash card with valid memory already loaded.

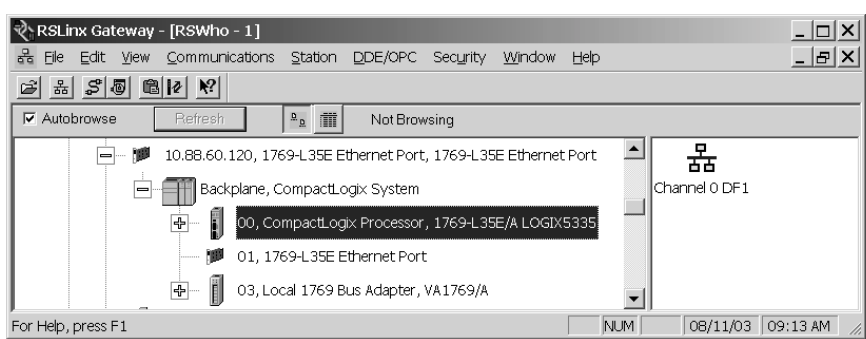
The firmware is available with RSLogix 5000 software or you can download it from the support website:

1. Go to http://support.rockwellautomation.com/
2. In the left column (frame), select Firmware Updates under Technical Support
3. Select the firmware revision.

   The download process will require you to enter the serial number of your RSLogix 5000 programming software.

If you load (flash) controller firmware via the ControlFlash or AutoFlash utilities, you need a serial, ControlNet or EtherNet/IP connection to the controller. Flashing via a ControlNet or EtherNet/IP connection is faster than the serial connection. The controller's EtherNet/IP configuration settings are maintained during a flash process.

If you load firmware via a ControlNet or EtherNet/IP connection, browse through the network port, across the virtual backplane, and select the appropriate controller. The example below shows an EtherNet/IP connection.



Using ControlFlash to load firmware

Depending on your controller type, you can use ControlFlash to load firmware through one of the following:

- ControlNet connection – available on the 1769-L35CR only
- an Ethernet connection (an IP address must already be assigned to the Ethernet port) – available on the 1769-L32E and 1769-L35E only
- a serial connection – available with all CompactLogix controllers.

1. Make sure the appropriate network connection is made before starting.
2. Start the ControlFlash utility. Click Next when the Welcome screen appears.
3. Select the catalog number of the controller and click Next.
4. Expand the network until you see the controller. If the required network is not shown, first configure a driver for the network in RSLinx software.

   If you use an Ethernet connection to load the firmware, the utility will require a valid IP address before connecting to the controller.
5. Select the controller and click OK
6. Select the revision level to which you want to update the controller and click Next.
7. To start the update of the controller, click Finish and then click Yes.
8. After the controller is updated, the status box displays *Update complete*. Click OK.
9. To close ControlFlash software, click Cancel and then click Yes.

Using AutoFlash to load firmware

You can use AutoFlash to load firmware through either a ControlNet or Ethernet connection (an IP address must already be assigned to the Ethernet port) or a serial connection.

1. Make sure the appropriate network connection is made before starting.

2. Use RSLogix 5000 programming software to download a controller project. If the processor firmware does not match that project revision, AutoFlash automatically launches.

3. Select the catalog number of the controller and click Next.

4. Expand the network until you see the controller. If the required network is not shown, first configure a driver for the network in RSLinx software.

   If you use an Ethernet connection to load the firmware, the utility will ask for a valid IP address before connecting to the controller.

5. Select the controller and click OK

6. Select the revision level to which you want to update the controller and click Next.

7. To start the update of the controller, click Finish and then click Yes.

8. After the controller is updated, the status box displays *Update complete*. Click OK.

9. To close AutoFlash software, click Cancel and then click Yes.

Using a CompactFlash card to load firmware

The 1769-L35CR, 1769-L35E, 1769-L32E, and 1769-L31 controllers support CompactFlash. A CompactFlash card provides nonvolatile memory for the controller. This is an optional feature and is not required to operate the controller.

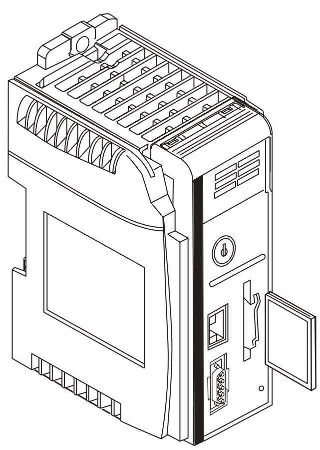
ATTENTION	Do not remove the CompactFlash card while the controller is reading from or writing to the card, as indicated by a flashing green CF LED. This could corrupt the data on the card or in the controller, as well as corrupt the latest firmware in the controller.

To install the card, do the following steps:

1. Push the locking tab to the right.

2. Insert the 1784-CF64 Industrial CompactFlash card into the socket on the front of the controller. The label of the CompactFlash card faces towards the left. Match the orientation arrow on the card with the arrow on the front of the controller.

Figure 1.2



The CompactFlash card supports removal and insertion under power.

WARNING

When you insert or remove the CompactFlash Card while power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding. Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

To remove the CompactFlash card, push the locking tab away from the CompactFlash card and pull the CompactFlash card from the socket.

If you have an existing 1769-L3xx controller that is already configured and has firmware loaded, you can store the current controller user program and firmware on CompactFlash and use that card to update other controllers.

1. Store the controller user program and firmware of a currently configured 1769-L3xx controller to the CompactFlash card.

TIP

Make sure to select Load Image On Powerup when you save to the card.

2. Remove the card and insert it into a 1769-L3xx controller that you want to have the same firmware and controller user program.

3. When you power up the second 1769-L3xx controller, the program and firmware image stored on the CompactFlash card is loaded into the controller.

Connect the 1769-BA Battery

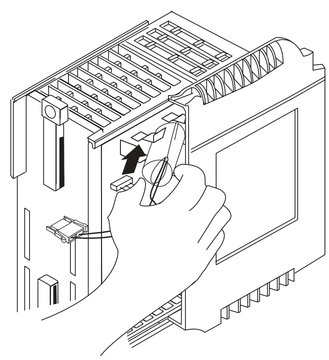
The controller is shipped with the 1769-BA battery packed separately. To connect the battery, follow the procedure shown below.

ATTENTION	The 1769-BA battery is the only battery you can use with the 1769-L31, 1769-L32E, 1769-L35CR and 1769-L35E CompactLogix controllers. The 1747-BA battery is not compatible with these CompactLogix controllers and may cause problems.

IMPORTANT	Do not remove the plastic insulation covering the battery. The insulation is necessary to protect the battery contacts.

1. Insert the battery into the battery port.

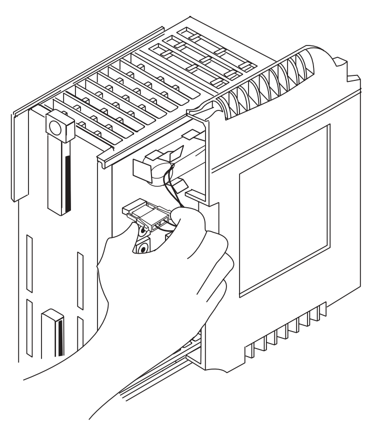
Figure 1.3



31499-M

2. Insert the battery connector into the connector port. The connector is keyed to engage with the correct polarity.

Figure 1.4



31500-M

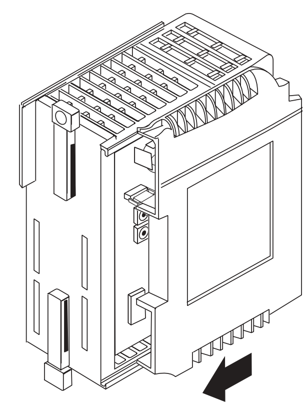
3. Slide the side cover back until it clicks into position.

WARNING

When you connect or disconnect the battery an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

For Safety information on the handling of lithium batteries, including handling and disposal of leaking batteries, see *Guidelines for Handling Lithium Batteries*, publication AG 5-4.

Figure 1.5



Automatic Save of User Program

When the 1769-BA battery is installed, the user program is non-volatile and maintained during interruptions in power to the controller (e.g., outages or cycles).

Table 1.3 describes typical battery life in certain conditions.

Table 1.3

Time ON/OFF	at 25° C (77° F)	at 40° C (104° F)	at 60° C (140° F)
Always OFF	14 months	12 months	9 months
ON 8 hours per day 5 days per week	18 months	15 months	12 months
ON 16 hours per day 5 days per week	26 months	22 months	16 months
Always ON	There is almost no drain on the battery when the controller is always ON.		

Using CompactFlash

The 1784-CF64 CompactFlash card provides nonvolatile memory storage for the 1769-L3xx controller. The card stores the contents of the controller memory (program logic and tag values) and the controller firmware at the time that you store the project. Storing information to the CompactFlash card is like storing a snapshot of controller memory at a given time.

ATTENTION	If you configured the CompactFlash card to "restore on power up" and you make changes to a project, such as online edits or changes to tag values, you must store the project to the CompactFlash card again after you make changes. Otherwise, your changes are not saved and you will lose those changes on the next power cycle to the controller.

Tag values stored in flash are a snapshot at the time of the store. During a program restore the processor tag values will be equal to tag data stored on flash.

The locking tab on the front of the controller helps hold the CompactFlash card in its socket.

ATTENTION	Do not remove the CompactFlash card while the controller is reading from or writing to the card, as indicated by a flashing green CF LED. This could corrupt the data on the card or in the controller, as well as corrupt the latest firmware in the controller.

The CompactFlash card supports removal and insertion under power.

WARNING	When you insert or remove the card while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding. Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

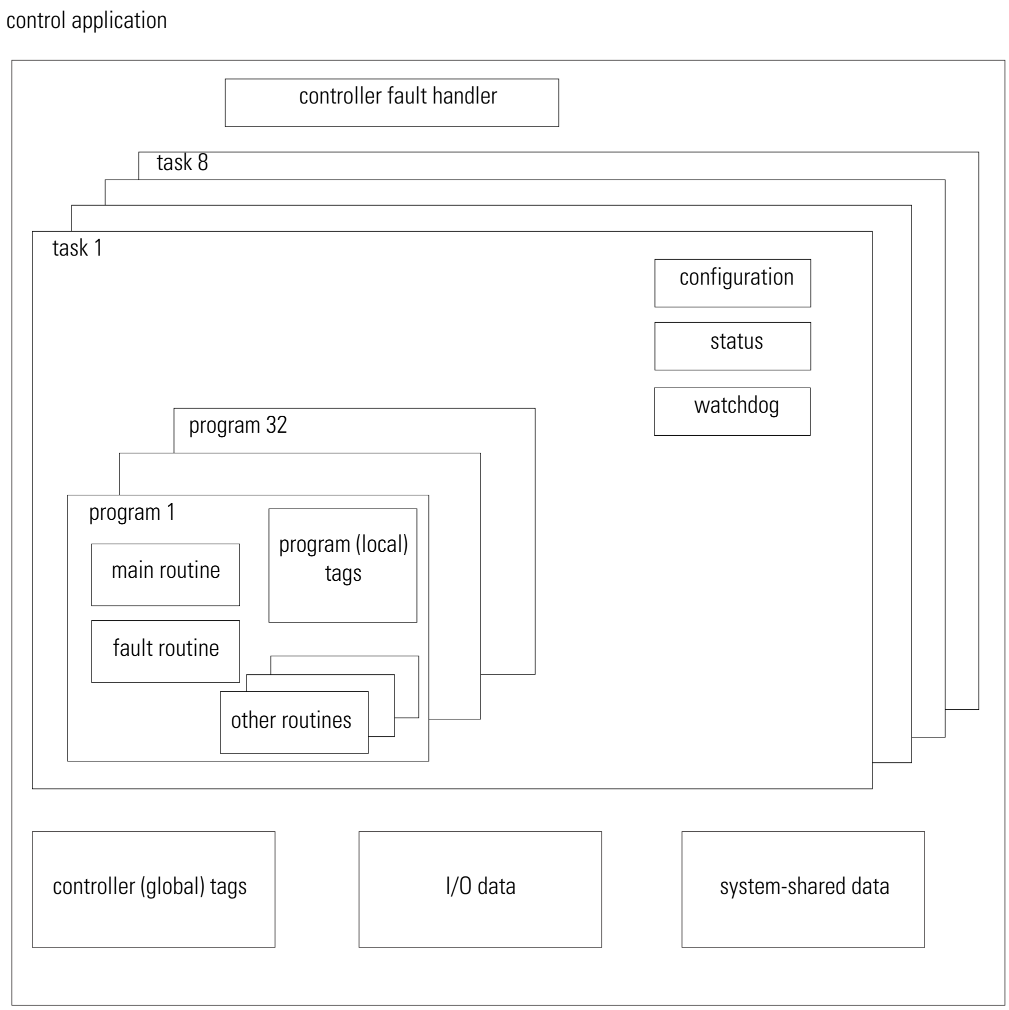
See the *Logix5000 Controllers Common Procedures Programming Manual*, publication 1756-PM001 for steps on storing an image on the CompactFlash card.

Developing Programs

The controller operating system is a preemptive multitasking system that is IEC 1131-3 compliant. This environment provides:

- tasks to configure controller execution
- programs to group data and logic
- routines to encapsulate executable code written in a single programming language

Figure 1.6



Defining tasks

A task provides scheduling and priority information for a set of one or more programs. You can configure tasks as continuous, periodic, or event. Only one task can be continuous.

Table 1.4

This controller:	Supports this many tasks:
1769-L35CR	8
1769-L35E	8
1769-L32E	6
1769-L31	4

A task can have as many as 32 separate programs, each with its own executable routines and program-scoped tags. Once a task is triggered (activated), all the programs assigned to the task execute in the order in which they are grouped. Programs can only appear once in the Controller Organizer and cannot be shared by multiple tasks.

Specifying task priorities

Each task in the controller has a priority level. The operating system uses the priority level to determine which task to execute when multiple tasks are triggered. You can configure periodic tasks to execute from the lowest priority of 15 up to the highest priority of 1. A higher priority task will interrupt any lower priority task. The continuous task has the lowest priority and is always interrupted by a periodic task.

The CompactLogix controller uses a dedicated periodic task at priority 7 to process I/O data. This periodic task executes at the RPI you configure for the CompactBus, which can be as fast as once every 1 ms. Its total execution time is as long as it takes to scan the configured I/O modules.

How you configure your tasks affects how the controller receives I/O data. Tasks at priorities 1 to 6 take precedence over the dedicated I/O task. Tasks in this priority range can impact I/O processing time. If you configure the I/O RPI at 1ms and you configure a task of priority 1 to 6 that requires 500 µs to execute and is scheduled to run every millisecond. This leaves the dedicated I/O task 500 µs to complete its job of scanning the configured I/O.

However, if you schedule two high priority tasks (1 to 6) to run every millisecond, and they both require 500 μs or more to execute, no CPU time would be left for the dedicated I/O task. Furthermore, if you have so much configured I/O that the execution time of the dedicated I/O task approaches 2 ms (or the combination of the high priority tasks and the dedicated I/O task approaches 2 ms) no CPU time is left for low priority tasks (8 to 15).

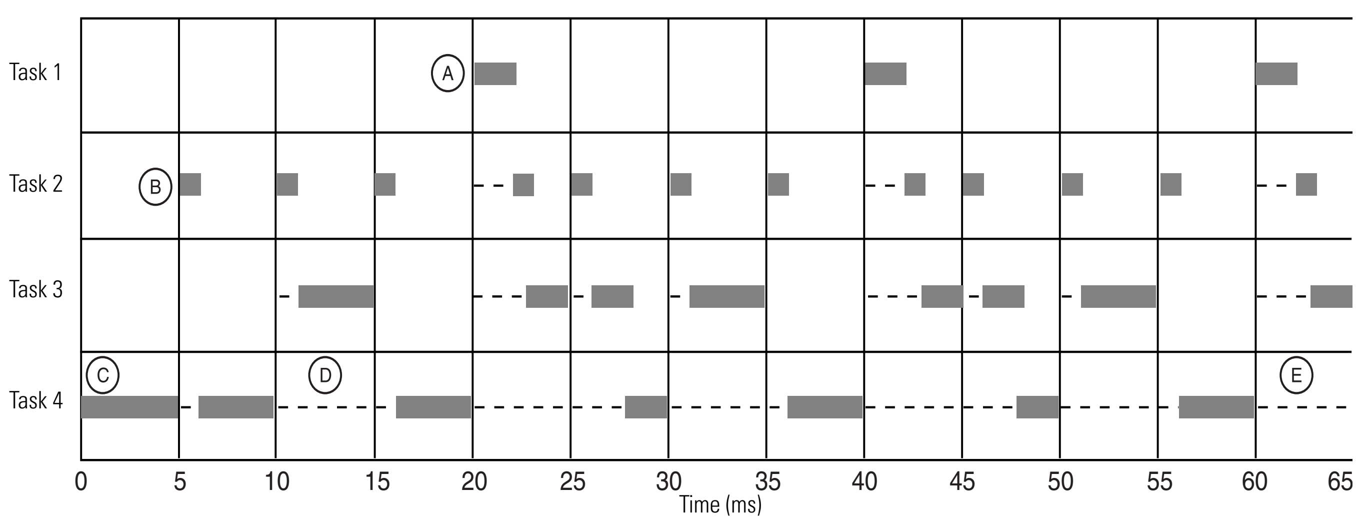
TIP

For example, if your program needs to react to inputs and control outputs at a deterministic rate, configure a periodic task with a priority higher than 7 (1 through 6). This keeps the dedicated I/O task from affecting the periodic rate of your program. However, if your program contains a lot of math and data manipulation, place this logic in a task with priority lower than 7 (8 through 15), such as the continuous task, so that the dedicated I/O task is not adversely affected by your program.

The following example shows the task execution order for an application with periodic tasks and a continuous task.

Table 1.5

Task:	Priority Level:	Task Type:	Example Execution Time:	Worst Case Completion Time:
1	5	20 ms periodic task	2 ms	2 ms
2	7	dedicated I/O task 5 ms selected RPI	1 ms	3 ms
3	10	10 ms periodic task	4 ms	8 ms
4	none (lowest)	continuous task	25 ms	60 ms



Notes:

A. The highest priority task interrupts all lower priority tasks.

B. The dedicated I/O task can be interrupted by tasks with priority levels 1 to 6. The dedicated I/O task interrupts tasks with priority levels 8 to 15. This task runs at the selected RPI rate scheduled for the CompactLogix system (2ms in this example).

C. The continuous task runs at the lowest priority and is interrupted by all other tasks.

D. A lower priority task can be interrupted multiple times by a higher priority task.

E. When the continuous task completes a full scan it restarts immediately, unless a higher priority task is running.

Defining programs

Each program contains program tags, a main executable routine, other routines, and an optional fault routine. Each task can schedule as many as 32 programs.

The scheduled programs within a task execute to completion from first to last. Programs that are not attached to any task show up as unscheduled programs. You must specify (schedule) a program within a task before the controller can scan the program.

Defining routines

A routine is a set of logic instructions in a single programming language, such as ladder logic. Routines provide the executable code for the project in a controller. A routine is similar to a program file or subroutine in a PLC or SLC controller.

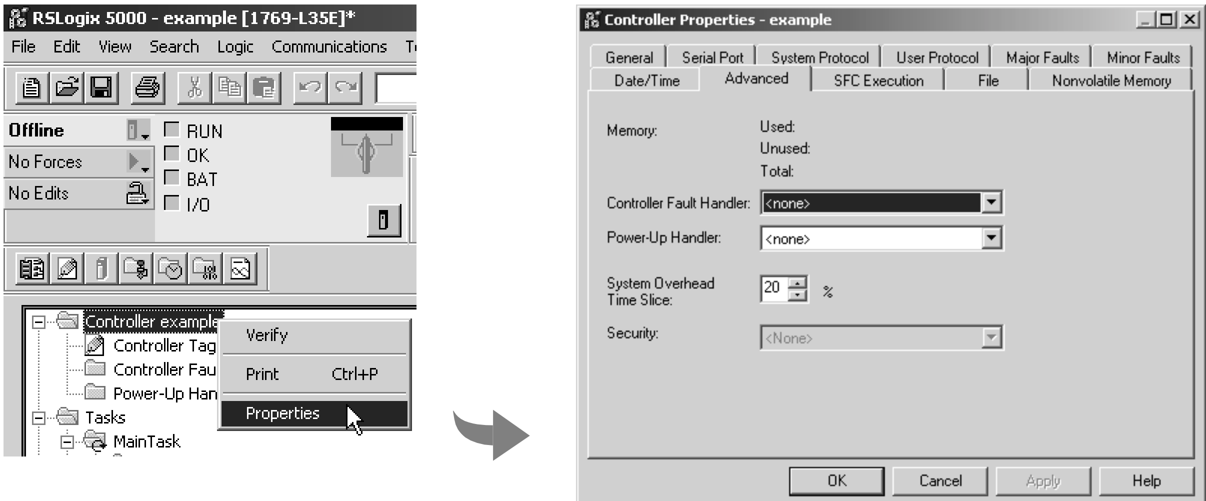
Each program has a main routine. This is the first routine to execute when the controller triggers the associated task and calls the associated program. Use logic, such as the Jump to Subroutine (JSR) instruction, to call other routines.

You can also specify an optional program fault routine. The controller executes this routine if it encounters an instruction-execution fault within any of the routines in the associated program.

Selecting a System Overhead Percentage

The Controller Properties dialog lets you specify a percentage for system overhead. This percentage specifies the percentage of controller time (excluding the time for periodic tasks) that is devoted to communication and background functions.

1. View properties for the controller and select the Advanced tab.



System overhead functions include:

- communicating with programming and HMI devices (such as RSLogix 5000 software)
- responding to messages
- sending messages

The controller performs system overhead functions for up to 1 ms at a time. If the controller completes the overhead functions in less than 1 ms, it resumes the continuous task.

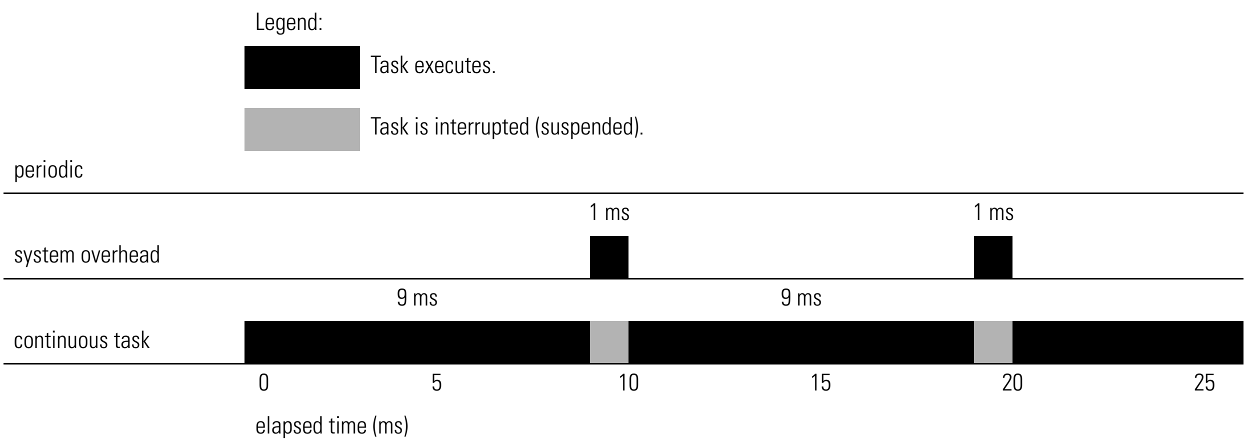
As the system overhead percentage increases, time allocated to executing the continuous task decreases. If there are no communications for the controller to manage, the controller uses the communications time to execute the continuous task. While increasing the system overhead percentage does increase communications performance, it also increases the amount of time it takes to execute a continuous task - increasing overall scan time

Table 1.6 shows the ratio between the continuous task and the system overhead functions:

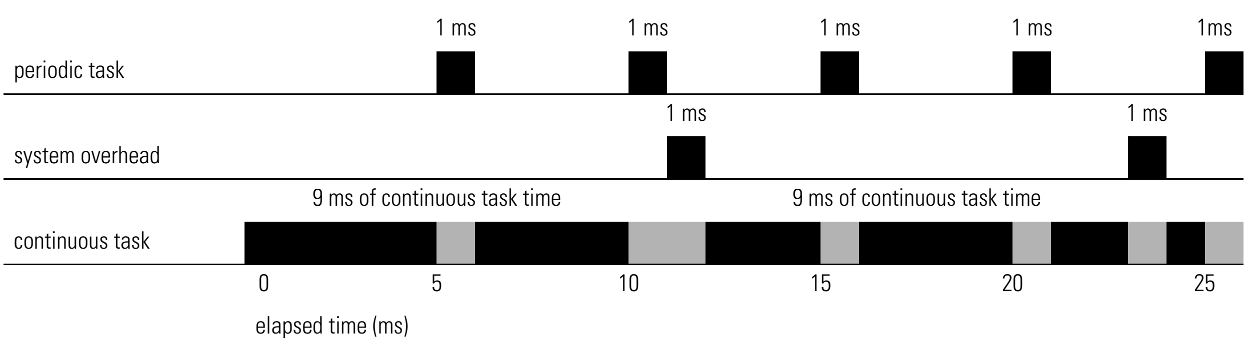
Table 1.6

At this time slice:	The continuous tasks runs for:	And then overhead occurs for up to:
10%	9 ms	1 ms
20%	4 ms	1 ms
33%	2 ms	1 ms
50%	1 ms	1 ms

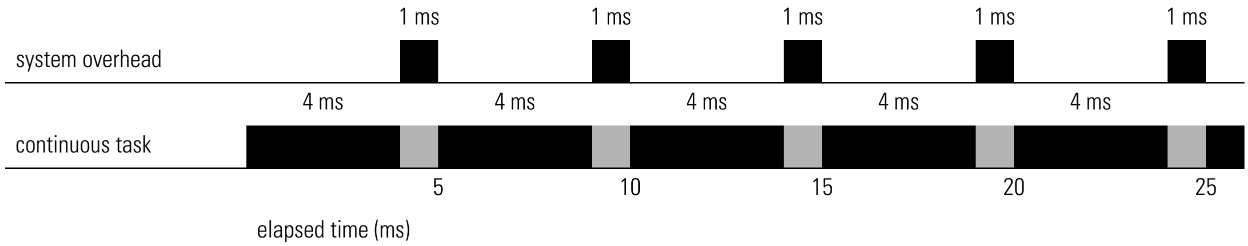
At a time slice of 10%, system overhead interrupts the continuous task every 9 ms (of continuous task time), as illustrated below.



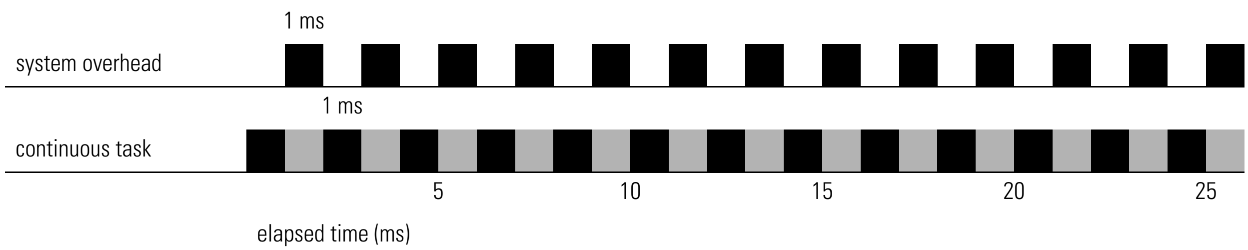
The interruption of a periodic task increases the elapsed time (clock time) between the execution of system overhead, as shown below.



If you use the default time slice of 20%, the system overhead interrupts the continuous task every 4 ms (of continuous task time).



If you increase the time slice to 50%, the system overhead interrupts the continuous task every 1 ms (of continuous task time).



If the controller only contains a periodic task(s), the system overhead timeslice value has no effect. System overhead runs whenever a periodic task is not running.

Placing, Configuring, and Monitoring Local I/O

Using This Chapter

Use this chapter to control local I/O with your CompactLogix controller.

Table 2.1

Placing Local I/O Modules

The controller you use determines how many local I/O modules you can configure.

Table 2.2

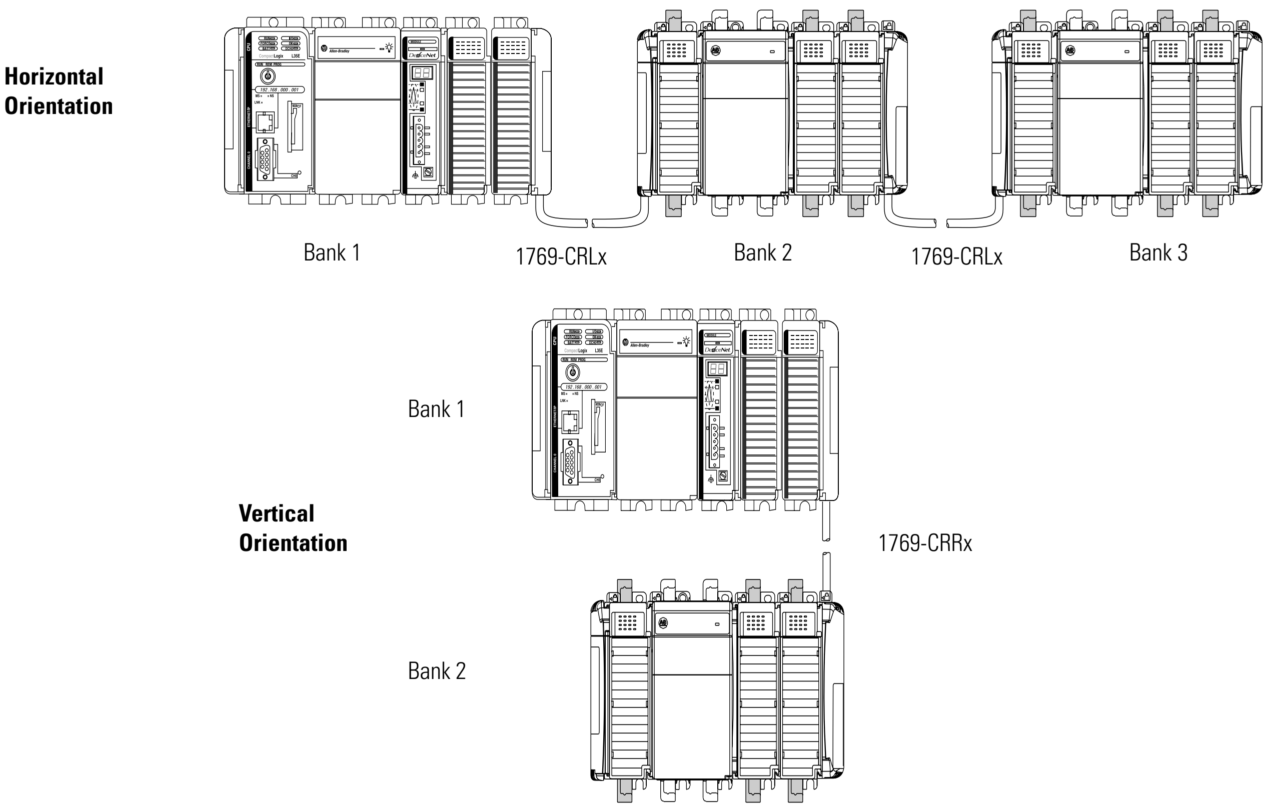
This controller:	Supports this many local I/O modules:	In this many I/O banks:
1769-L35CR	30	3
1769-L35E	30	3
1769-L32E 1769-L31	16	3

Use the 1769-CRR1/-CRR3 or 1769-CRL1/-CRL3 expansion cable to connect banks of I/O modules. You can split a bank right after the power supply or after any I/O module. Each bank must contain one power supply. An end cap/terminator must be used on the last I/O bank opposite of the expansion cable.

The first bank includes the CompactLogix controller in the far left position. The controller must be located within 4 positions of the bank's power supply. Only one controller can be used in a CompactLogix system.

Each I/O module also has a power supply distance rating (the number of modules from the power supply). The distance rating is printed on each module's label. Each module must be located within its distance rating.

Figure 2.1



ATTENTION

The CompactLogix system does not support Removal and Insertion Under Power (RIUP). While the CompactLogix system is under power:

- any break in the connection between the power supply and the controller (i.e. removing the power supply, controller, or an I/O module) may subject the logic circuitry to transient conditions above the normal design thresholds and may result in damage to system components or unexpected behavior.
- removing an end cap or an I/O module faults the controller and may also result in damage to system components.

Validating I/O Layout

To validate your planned I/O layout, consider these requirements:

- As you add modules, the minimum backplane RPI increases.
- The I/O modules must be distributed such that the current consumed from the left or right side of the power supply never exceeds 2.0A at 5V dc and 1.0A at 24V dc.

Estimating RPI

As you install modules, the minimum backplane RPI increases. The RPI (request packet interval) defines the frequency at which the controller sends and receives all I/O data on the backplane. There is one RPI for the entire 1769 backplane. Consider these guidelines when installing modules:

Table 2.3

Type of Module:	Considerations:
digital and analog (any mix)	• 1-4 modules can be scanned in 1.0 ms • 5-16 modules can be scanned in 1.5 ms • 17-30 modules can be scanned in 2.0 ms • some input modules have a fixed 8.0 ms filter, so selecting a faster RPI has no affect
specialty	• "full-sized" 1769-SDN modules add 1.5 ms per module • 1769-HSC modules add 0.5 ms per module

You can always select an RPI that is slower than listed above. These considerations show how fast modules can be scanned - not how fast an application can use the data. The RPI is asynchronous to the program scan. Other factors, such as program execution duration, affect I/O throughput.

System power budget calculation

To validate your system, the total 5V dc current and 24V dc current consumed must be considered. The I/O modules must be distributed such that the current consumed from the left or right side of the power supply never exceeds 2.0A at 5V dc and 1.0A at 24V dc.

Table 2.4

Catalog Number	Number of Modules	Module Current Requirements		Calculated Current = (Number of Modules) x (Module Current Requirements)	
		at 5V dc (in mA)	at 24V dc (in mA)	at 5V dc (in mA)	at 24V dc (in mA)
1769-ADN		500	0		
1769-ASCII		5	0		
1769-ECR(1)		5	0		
1769-ECL(1)		5	0		
1769-HSC		425	0		
1769-IA16		115	0		
1769-IA8I		90	0		
1769-IM12		100	0		
1769-IF4		120	60		
1769-IF8		120	70		
1769-IF4XOF2		120	160		
1769-IQ16		115	0		
1769-IQ16F		110	0		
1769-IQ32		170	0		
1769-IQ6XOW4		105	50		
1769-IR6		100	45		
1769-IT6		100	40		
1769-L31		330	40		
1769-L32E		660	90		
1769-L35CR		680	40		
1769-L35E		660	90		
1769-OA16		225	0		
1769-OA8		145	0		
1769-OB16		200	0		
1769-OB16P		160	0		
1769-OB32		300	0		
1769-OB8		145	0		
1769-OF2		120	120		
1769-OF8C		145	160		

Table 2.4

Catalog Number	Number of Modules	Module Current Requirements		Calculated Current = (Number of Modules) x (Module Current Requirements)	
		at 5V dc (in mA)	at 24V dc (in mA)	at 5V dc (in mA)	at 24V dc (in mA)
1769-OF8V		145	160		
1769-OV16		200	0		
1769-OW8		125	100		
1769-OW8I		125	100		
1769-OW16		205	180		
1769-SDN		440	0		
1769-SM1		280	0		
1769-SM2		340	0		
			Total Current Required[2]:		

(1) One 1769-ECR or 1769-ECL end cap/terminator is required in the system. The end cap/terminator used is dependent on your configuration.

(2) This number must not exceed the Power Supply Current Capacity listed below.

Power supply current capacity

Table 2.5

Specification	1769-PA2	1769-PB2	1769-PA4	1769-PB4
Output Bus Current Capacity (0°C to +55°C)	2A at 5V dc and 0.8A at 24V dc		4A at 5V dc and 2A at 24V dc	
24V dc User Power Capacity (0°C to +55°C)	250 mA (maximum)	not applicable		

Determining When the Controller Updates I/O

The controller continually scans the control logic. One scan is the time it takes the controller to execute the logic once. Input data transfers to the controller and output data transfers to output modules are asynchronous to the logic scan.

TIP

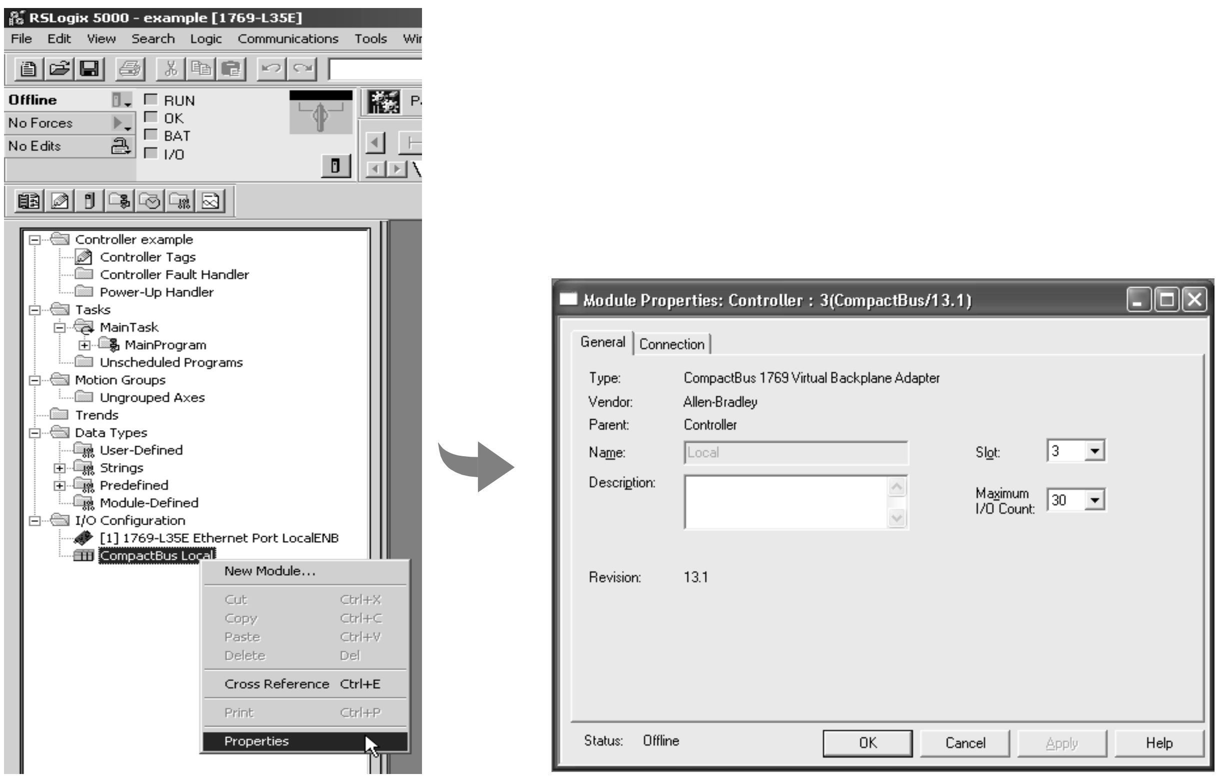
If you need to ensure that the I/O values being used during logic execution are from one moment in time (such as at the beginning of a ladder program), use the Synchronous Copy instruction (CPS) to buffer I/O data.

Refer to the *Logix5000 Controllers Common Procedures Programming Manual*, publication number 1756-PM001 for examples of I/O buffering or to the *Logix5000 Controllers General Instruction Set Reference Manual,* publication number 1756-RM003 for information on the CPS instruction.

Configuring the CompactBus

When you create a CompactLogix project, the programming software automatically creates the local CompactBus. You must configure the CompactBus.

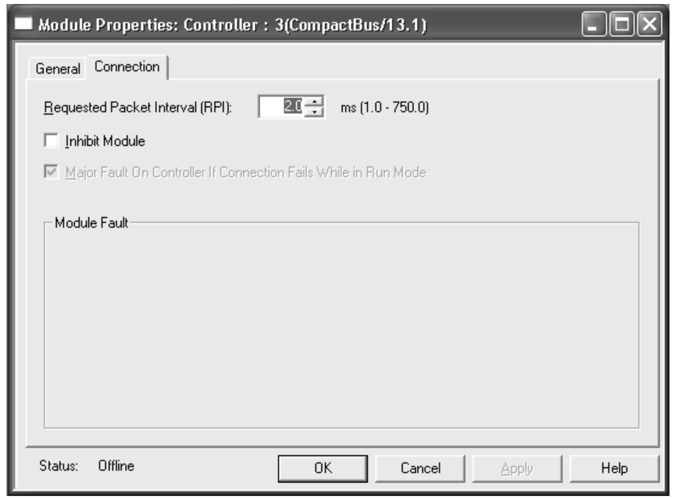
1. In the Controller Organizer, right-click on CompactBus Local.
2. Click and select Properties.



On the General tab, specify the size of the chassis. Enter the number of modules you plan to install. Include the CompactLogix controller in this total, along with a maximum of 30 I/O modules, not including the power supply.

The Comm Format for the CompactBus is automatically set to Rack Optimized and cannot be changed.

Using the Connection tab, you can specify the RPI for the systems and choose to inhibit or uninhibit the CompactBus.



The RPI you specify here is the RPI for every 1769 module on this controller's local CompactBus. Specify an RPI from 1-750ms for the system. You do not specify individual RPI values for each module.

By inhibiting and uninhibiting the CompactBus, you can write new configuration data to the entire system at once.

The controller's response to a CompactBus connection failure is fixed to always fault the controller. It is not configurable.

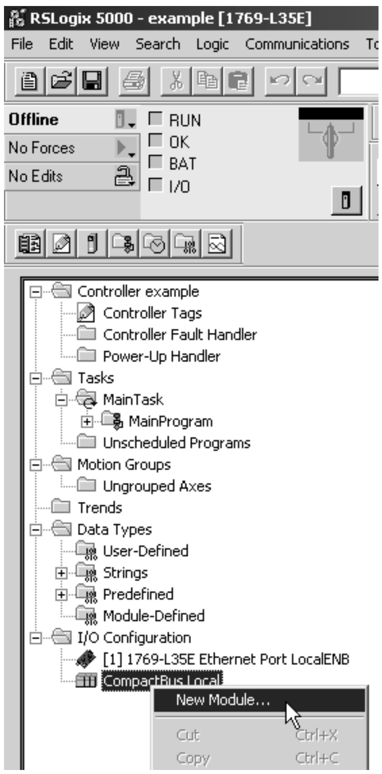
Configuring Local I/O Modules

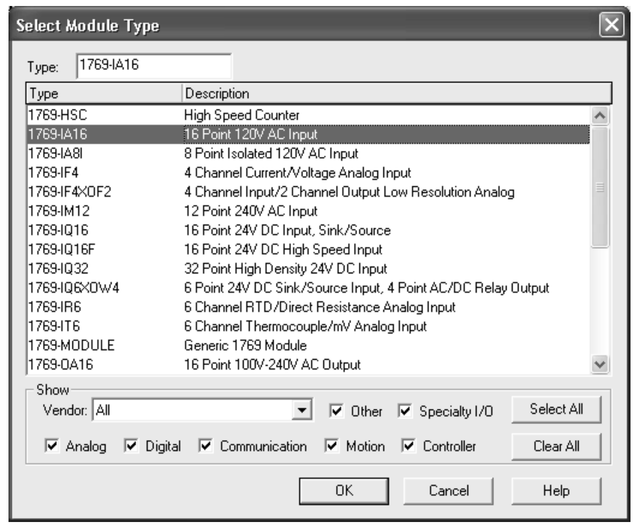
Use your programming software to configure the I/O modules for the controller.

1. In the Controller Organizer, right-click on CompactBus Local.

2. Click New Module.

3. Select the module (1769-IA16 in this example).

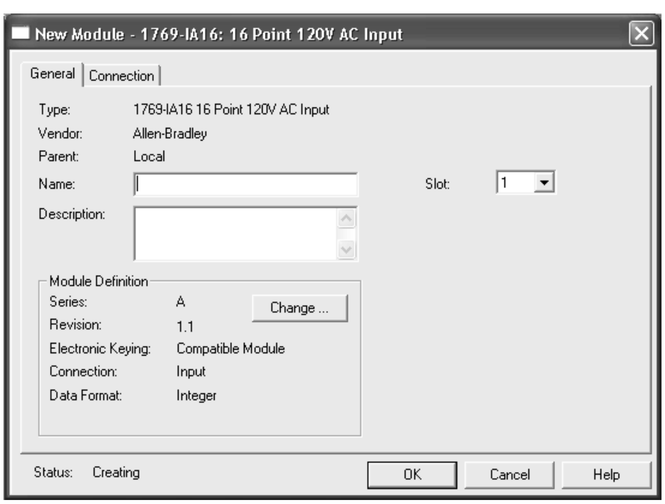




4. Click OK.

5. Configure the module, using the Next button to continue through the wizard.

6. Click Finish when you are done. The completed module appears in the Controller Organizer.



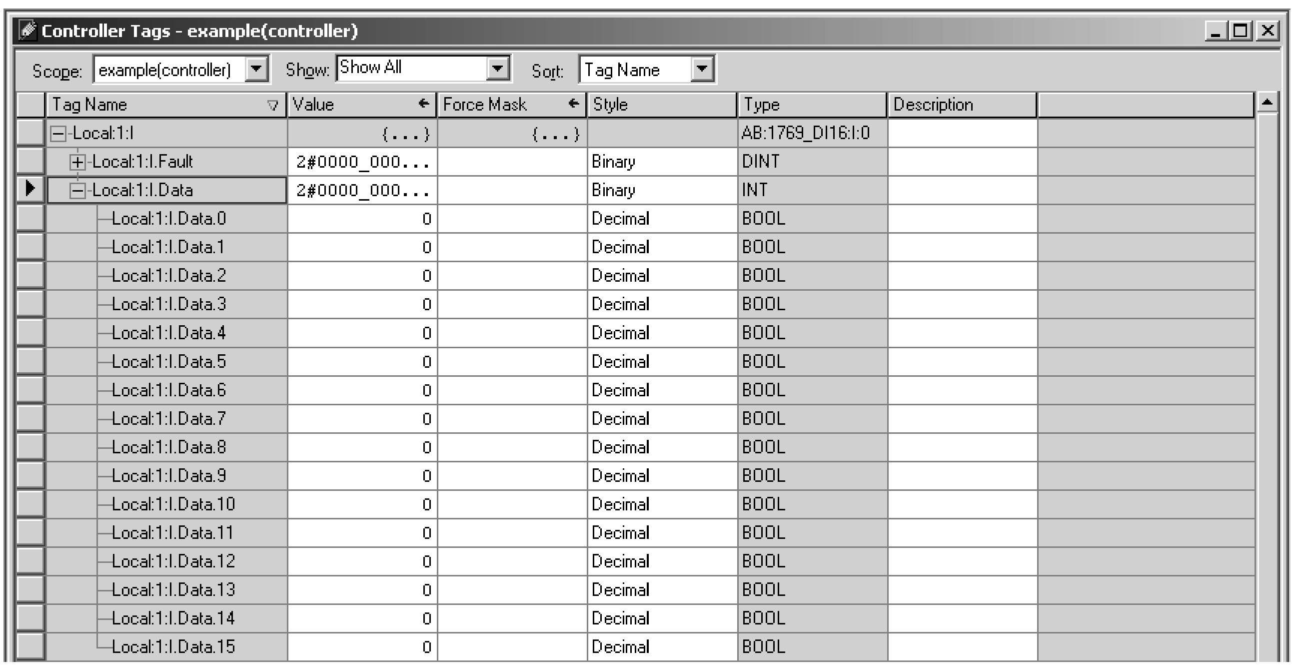
Communication formats

The communication format determines the data structure the I/O module uses. Each format supports a different data structure. Presently, the CompactLogix system supports two data formats:

- Input Data – INT (for 1769 input modules)
- Data – INT (for 1769 output modules)

TIP The CompactLogix controller must own its local I/O modules. No other Logix-based controller can own the local CompactLogix I/O.

The communication format determines the tag structure that is created for the module. Assume that a 1769-IA16 Input module is in slot 1. The software creates the appropriate tags using the slot number to differentiate the tags for this example module from any other module.


Controller Tags - example(controller)

Scope: example(controller) Show: Show All Sort: Tag Name

Tag Name	Value	Force Mask	Style	Type	Description
-Local:1:I	{...}	{...}		AB:1769_DI16:I:0	
+Local:1:I.Fault	2#0000_000...		Binary	DINT	
-Local:1:I.Data	2#0000_000...		Binary	INT	
Local:1:I.Data.0	0		Decimal	BOOL	
Local:1:I.Data.1	0		Decimal	BOOL	
Local:1:I.Data.2	0		Decimal	BOOL	
Local:1:I.Data.3	0		Decimal	BOOL	
Local:1:I.Data.4	0		Decimal	BOOL	
Local:1:I.Data.5	0		Decimal	BOOL	
Local:1:I.Data.6	0		Decimal	BOOL	
Local:1:I.Data.7	0		Decimal	BOOL	
Local:1:I.Data.8	0		Decimal	BOOL	
Local:1:I.Data.9	0		Decimal	BOOL	
Local:1:I.Data.10	0		Decimal	BOOL	
Local:1:I.Data.11	0		Decimal	BOOL	
Local:1:I.Data.12	0		Decimal	BOOL	
Local:1:I.Data.13	0		Decimal	BOOL	
Local:1:I.Data.14	0		Decimal	BOOL	
Local:1:I.Data.15	0		Decimal	BOOL	

Hold Last State and User-Defined Safe State not supported

When 1769 Compact I/O modules are used as local I/O modules in a CompactLogix system, the local I/O modules do not support the Hold Last State or User-Defined Safe State features, even though you can configure these options in the programming software.

- If a local I/O module fails such that its communication to the controller is lost, or if any module is disconnected from the system bus while under power, the controller will go into the fault mode. All outputs turn off when the system bus or any module faults.

- RSLogix 5000 software creates tags for modules when you add them to the I/O configuration. The 1769 module tags define configuration (C) data type members which may include attributes for alternate outputs. CompactLogix does not enable local modules to use the alternate outputs. Do not configure the attributes listed below:

For digital output modules:	For analog output modules:
• ProgToFaultEn • ProgMode • ProgValue • FaultMode • FaultValue	• CH*x*ProgToFaultEn • CH*x*ProgMode • CH*x*FaultMode • where CHx = the channel number

Any 1769 Compact I/O modules used as remote I/O modules in a DeviceNet system do support the Hold Last State and User-Defined Safe State features.

Inhibiting I/O module operation

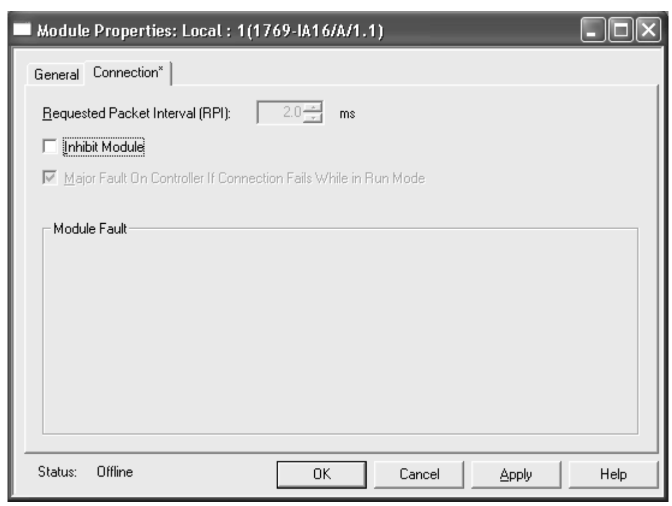
In some situations, such as when initially commissioning a system, it is useful to disable portions of a control system and enable them as you wire up the control system. The controller lets you inhibit individual modules or groups of modules, which prevents the controller from trying to communicate with these modules. Inhibiting a module shuts down the connection from the controller to that module.

When you create an I/O module, it defaults to being not inhibited. You can change an individual module's properties to inhibit a module.

ATTENTION

Inhibiting a module causes the connection to the module to be broken and prevents communication of I/O data. The controller and other I/O modules continue to operate based on old data from that module. To avoid potential injury and damage to machinery, make sure this does not create unsafe operation.

On the Connection tab of the Module Properties dialog, you can select to inhibit that specific module.



TIP

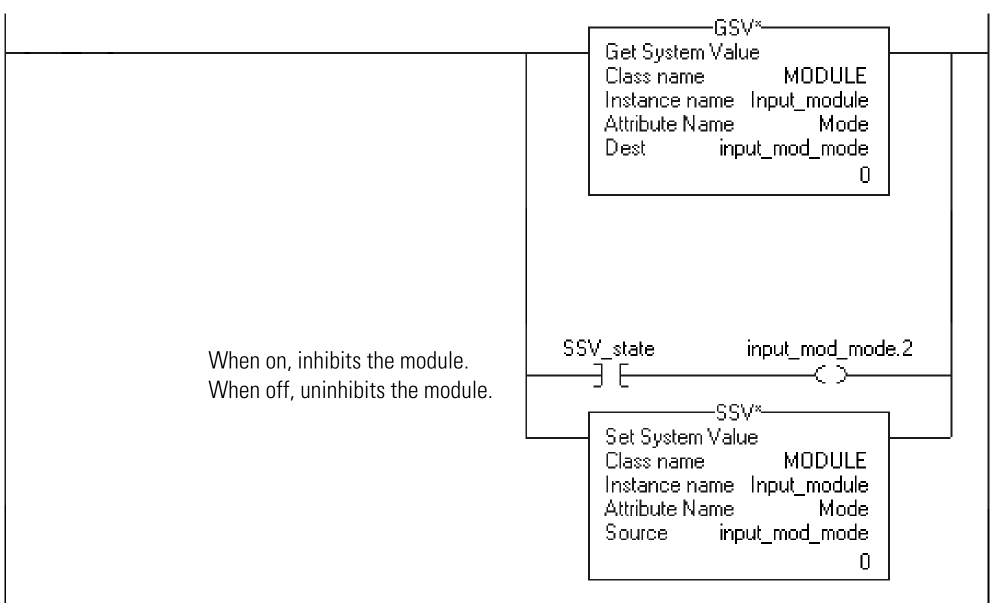
To easily inhibit all local I/O modules, you can inhibit the CompactBus, which in turn inhibits all the modules on that bus. See Configuring the CompactBus on page 2-6.

When you select to inhibit a module, the controller organizer displays a yellow circle symbol over the module.

If you are:	Inhibit a module to:
offline	put a place holder for a module you are configuring. The inhibit status is stored in the project. When you download the project, the module is still inhibited.
online	stop communication to a module. • If you inhibit a module while you are connected to the module, the connection to the module is closed. The module's outputs turn off. • If you inhibit a module but a connection to the module was not established (perhaps due to an error condition or fault), the module is inhibited. The module status information changes to indicate that the module is inhibited and not faulted. • If you uninhibit a module (clear the check box), and no fault condition occurs, a connection is made to the module and the module is dynamically reconfigured with the configuration you created for that module. • If you uninhibit the module and a fault condition occurs, a connection is not made to the module. The module status information changes to indicate the fault condition.

To inhibit a module from logic, you must first read the Mode attribute for the module using a GSV instruction. Set bit 2 to the inhibit status (1 to inhibit or 0 to uninhibit). Use a SSV instruction to write the Mode attribute back to the module. For example:

The GSV instruction gets the current status of the module named "input_module." The SSV instruction sets the state of "input_module" as either inhibited or uninhibited.



Sending module configuration information

The controller sends module configuration information once module connections are established.

ATTENTION

If you make a configuration change to any module in the system do one of the following to resend module configuration data:

- cycle power to the controller
- inhibit and then uninhibit the bus
- inhibit and then uninhibit the individual module
- send a MSG instruction of type Module Reconfigure (for information on configuring a MSG to send configuration data, see the *Logix5000 Controllers General Instructions Reference Manual*, publication 1756-RM003)

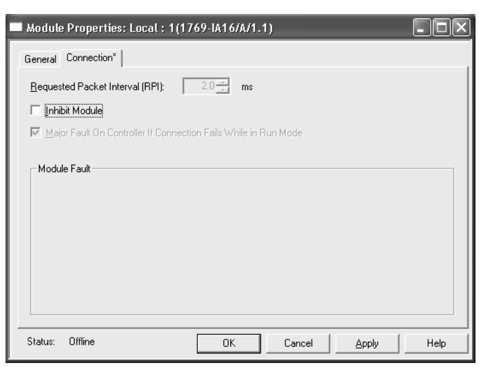
Configuring the controller's response to a connection failure

In a CompactLogix system, the controller's response to a CompactBus connection failure is fixed to always fault the controller. The CompactBus setting supersedes the individual module's setting.

IMPORTANT

The controller's response to a connection failure of any I/O module is fixed to always fault the controller.

If the local Compact Bus adapter faults, you should power cycle the controller to clear the fault after it is corrected. Often these faults are caused by the module latches being closed incorrectly.



The I/O modules respond to a connection failure by turning off output.

Accessing I/O Data

The programming software displays I/O data as structures of multiple tags that depend on the specific features of the I/O module. The names of the data structures are based on the location of the I/O module. The programming software automatically creates the necessary structures and tags when you configure the module. Each tag name follows this format:

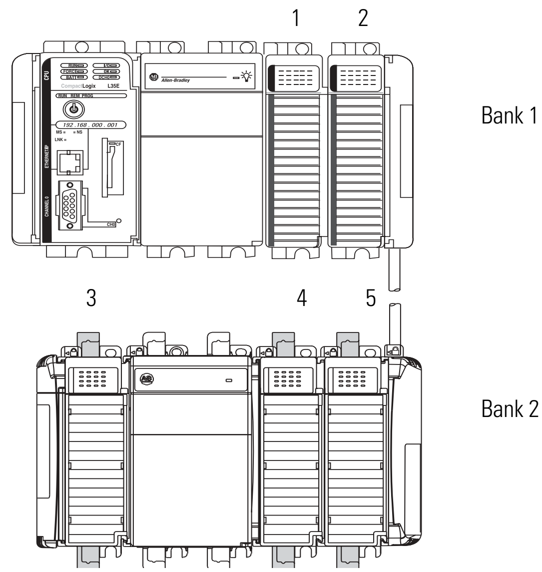
Location:SlotNumber:Type.MemberName.SubMemberName.Bit

where:

This address variable:	Is:
Location	Identifies network location LOCAL = local chassis
SlotNumber	Slot number of I/O module in its chassis
Type	Type of data I = input O = output C = configuration
MemberName	Specific data from the I/O module; depends on the type of data the module can store For example, Data and Fault are possible fields of data for an I/O module. Data is the common name for values that are sent to or received from I/O points.
SubMemberName	Specific data related to a MemberName.
Bit (optional)	Specific point on the I/O module; depends on the size of the I/O module (0-31 for a 32-point module)

This example shows addresses for data in a CompactLogix system.

EXAMPLE I/O module on the local CompactBus utilizing two banks



Sample tag names for this example:

Table 2.6

Location:	Example Tag Name:
input module in slot 1, LOCAL Bank 1	Local:1:C Local:1:I
output module in slot 2, LOCAL Bank 1	Local:2:C Local:2:I Local:2:O
analog input module in slot 3, LOCAL Bank 2	Local:3:C Local:3:I
analog output module in slot 4, LOCAL Bank 2	Local:4:C Local:4:I Local:4:O
analog input module in slot 5, LOCAL Bank 2	Local:5:C Local:5:I

Using aliases to simplify tag names

An alias lets you create a tag that represents another tag. This is useful for defining descriptive tag names for I/O values. For example:

Example:		Description:
I/O structure	Local:1:I:Data[0].0 Local:1:I:Fault.0	The aliases describe the specific I/O points.
alias	light_on = Local:1:I:Data[0].0 module_failed = Local:1:I:Fault.0	

Direct Connections for I/O Modules

Each local I/O module uses a direct connection to the CompactLogix controller. A direct connection is a real-time, data transfer link between the controller and an I/O module. The controller maintains and monitors the connection between the controller and the I/O module. Any break in the connection, such as a module fault, causes the controller to set fault status bits in the input data area associated with the module.

ATTENTION

The CompactLogix system does not support Removal and Insertion Under Power (RIUP). While the CompactLogix system is under power:

- any break in the connection between the power supply and the controller (i.e. removing the power supply, controller, or an I/O module) may subject the logic circuitry to transient conditions above the normal design thresholds and may result in damage to system components or unexpected behavior.
- removing an end cap or an I/O module faults the controller and may also result in damage to system components.

Monitoring I/O Modules

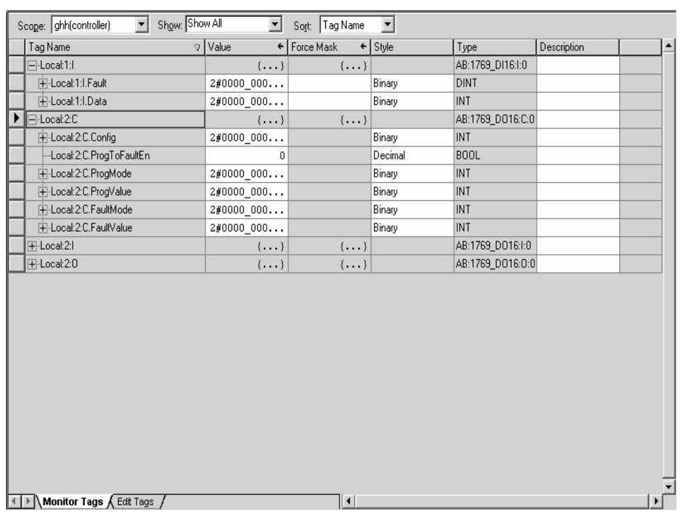
The CompactLogix controller offers different levels at which you can monitor I/O modules. You can:

- use the programming software to display fault data (See Displaying fault data on page 2-17)
- program logic to monitor fault data so you can take appropriate action (Refer to *Logix5000 Controllers Common Procedures Programming Manual*, publication number 1756-PM001, for examples.)

Displaying fault data

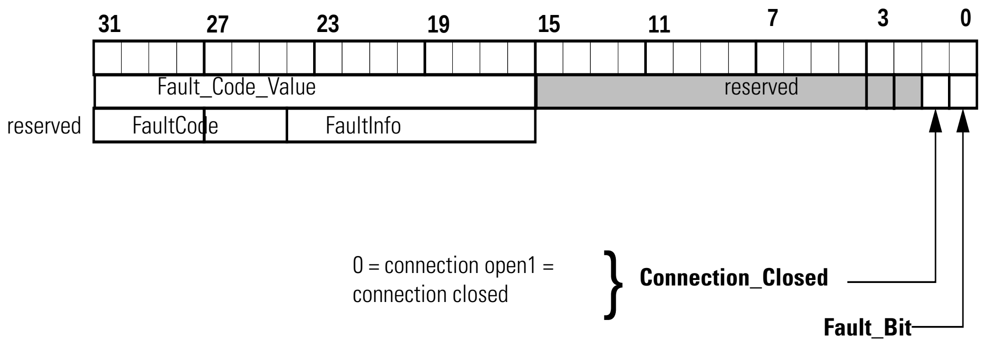
Fault data for certain types of module faults can be viewed through the programming software.

To view this data, select Controller Tags in the Controller Organizer. Right-click to select Monitor Tags.



The display for the fault data defaults to decimal. Change it to Hex to read the fault code.

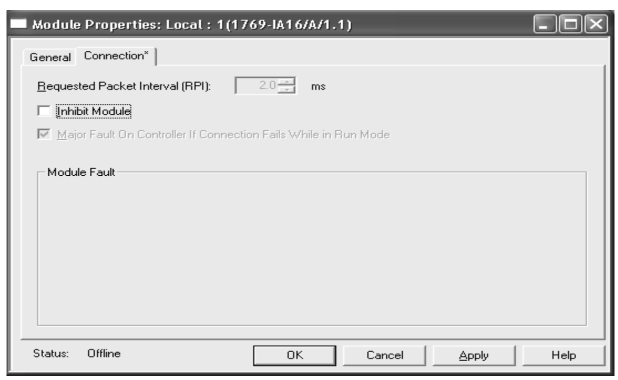
If the module faults, but the connection to the controller remains open, the controller tags database displays the fault value 16#0E01_0001. The fault word uses this format:



Where:

Bit	Description
Fault_Bit	This bit indicates that at least one bit in the fault word is set (1). If all the bits in the fault word are cleared (0), this bit is cleared (0).
Connection_Closed	This bit indicates whether the connection to the module is open (0) or closed (1). If the connection is closed (1), the Fault_Bit it set (1).

You can also view module fault data on the Connection tab of the Module Properties screen.



See your 1769 module's user documentation for a description of module faults. To recover from module faults, correct the module fault condition and send new data to the module by downloading the user program with configuration data, inhibiting and then uninhibiting the module, or cycling power.

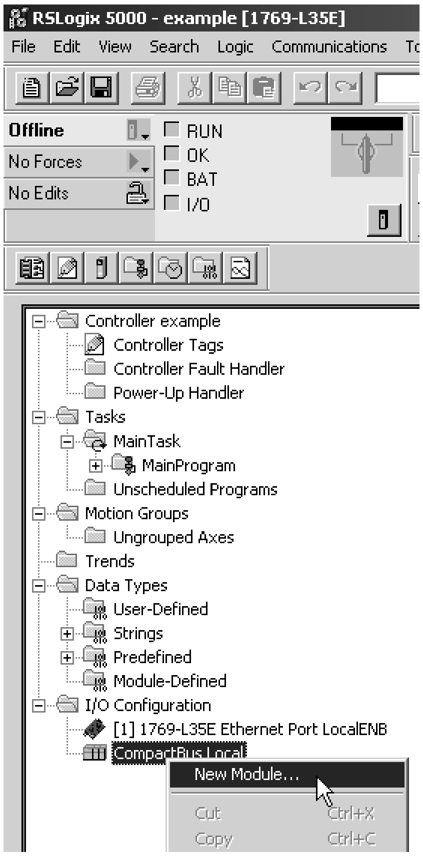
End-cap detection and module faults

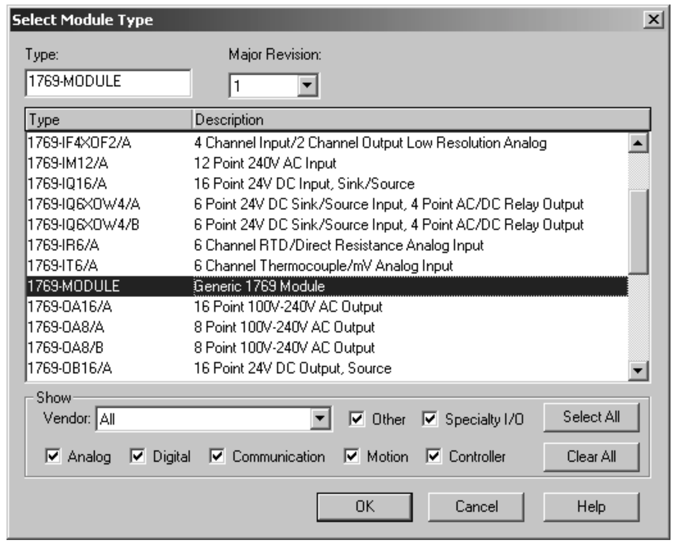
If a module that is not adjacent to an end cap experiences a fault and the connection to the controller is not broken, only the module enters the fault state. If a module that is adjacent to an end cap experiences a fault, both the module and the controller transition to the fault state.

Configuring I/O Modules Using the Generic 1769-MODULE

Use the Generic 1769 Module only when a 1769 I/O module does not appear in the list of modules to add to the Controller Organizer. To configure a 1769 I/O module for a CompactLogix controller using the generic 1769-MODULE:

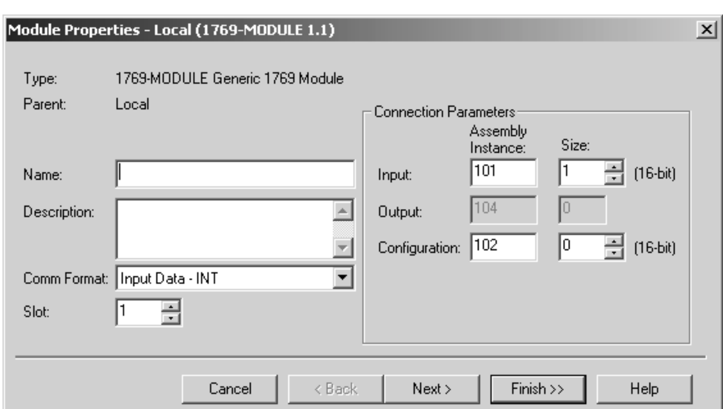
1. In the Controller Organizer, right-click on CompactBus Local.
2. Click New Module.
3. Select the 1769-MODULE (Generic 1769 Module).





4. Click OK.

5. Configure the module, using the Next button to continue through the wizard.
6. Click Finish when you are done. The completed module appears in the Controller Organizer.



The generic module requires you to specify more parameters of the module.

Important: The values you enter for these parameters are device specific. See the documentation for the device to determine which values to enter.

On the generic module screen, you define the parameters of the module.

Table 2.7

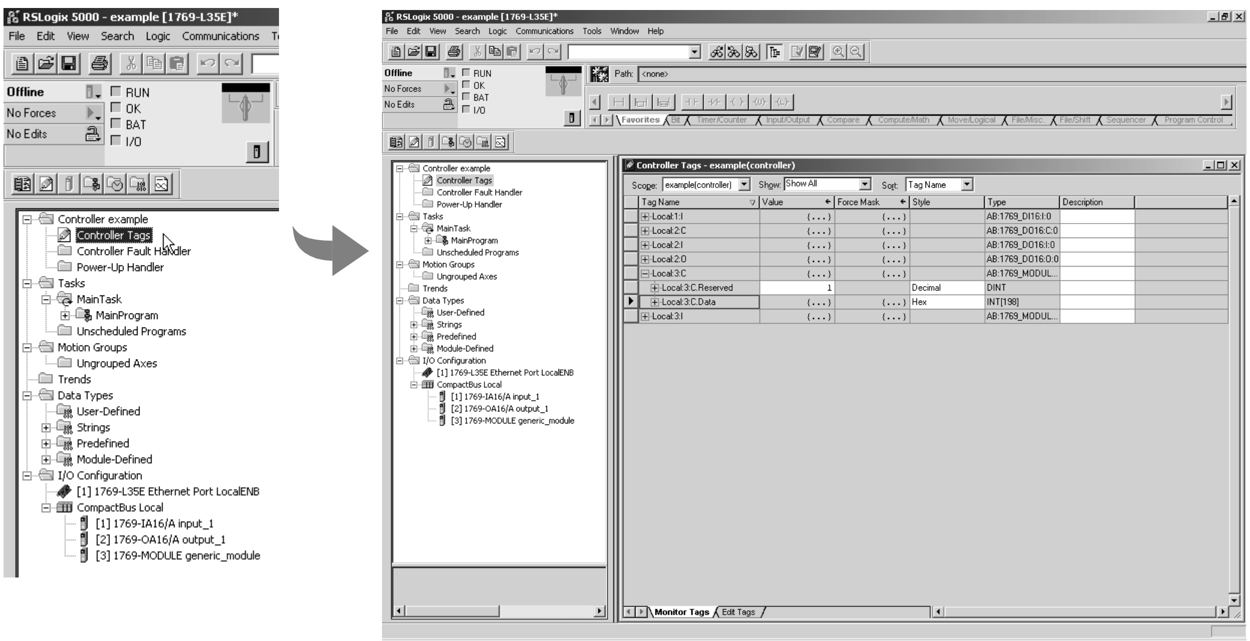
In this field:	Specify:
Name	name of the module
Description	(optional) provide more details about the module
Comm Format	communication format 1769 analog output modules, digital output modules, analog combination modules, and digital combination modules, use Data – INT. 1769 analog input modules and digital input modules use Input Data – INT.
Slot	slot placement of the module on the CompactBus
Connection Parameters Input Output Configuration	connection information unique to the module The documentation for module should list the assembly instance and size numbers for the input, output, and configuration parameters.

Entering the configuration information for the module

Once you configure a module using the generic 1769-MODULE, you must enter the configuration information for the module into the tag database. The configuration information is downloaded to the module at program download, power up, and whenever a module is inhibited and then uninhibited.

1. In the Controller Organizer, double-click on Controller Tags.

2. Edit the tags for the module so that the tags contain the appropriate configuration information.



The generic module was added to slot 3, so you want to enter configuration data into the Local:3:C tags.

RSLogix 5000 programming software automatically create tags for configured I/O modules. All local I/O addresses are preceded by the word Local. These addresses have the following format:

- Input Data: Local:*s*:I
- Output Data: Local:*s*:O
- Configuration Data: Local:*s*:C

Where *s* is the slot number assigned the I/O module.

Open the configuration tag for that module by clicking on the plus sign to the left of its configuration tag in the tag database. The configuration information depends on the module. See the documentation on the I/O module for the appropriate configuration information.

Notes:

Communicating with Devices on an EtherNet/IP Network

Using This Chapter

The 1769-L32E and 1769-L35E controllers have a built-in EtherNet/IP port that supports program upload/download, messaging, and distributed I/O over an EthetNet/IP network.

Table 3.1

For the CompactLogix controller to operate on an Ethernet network, you need:

- a 1769-L32E or 1769-L35E CompactLogix controller with valid firmware loaded. For more information on how to load firmware, see page 1-4.
- RSLinx software to configure the EtherNet/IP communication driver
- RSLogix5000 programming software

Connect the RJ-45 connector of the Ethernet cable to the Ethernet port (top port, CH1) on the controller.

ATTENTION

Do not plug a DH-485 network cable or a NAP port cable into the Ethernet port. Undesirable behavior and/or damage to the port may result.

Configuring Your System for an EtherNet/IP Network

The 1769-L32E and 1769-L35E controller ships with BOOTP enabled. You must assign an IP address to the Ethernet port in order for the controller to communicate over an EtherNet/IP network.

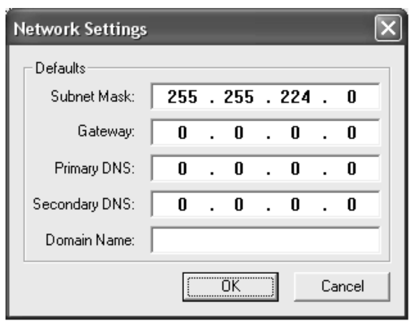
Step 1: Assigning network parameters

The BOOTP/DHCP utility is a stand alone program that is located in the:

- BOOTP-DHCP Server folder in the Rockwell Software program folder on the Start menu (the utility is automatically installed when you install RSLinx software)
- Tools directory on the RSLogix 5000 installation CD.

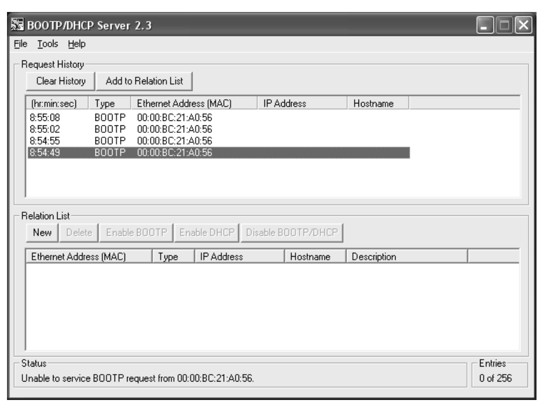
To use the BOOTP/DHCP utility:

1. Start the BOOTP/DHCP software.
2. Select Tool →Network Settings.
3. Type the Ethernet mask and gateway.
4. Click OK



5. In the Request History panel you see the hardware addresses of devices issuing BOOTP requests. Double-click on the hardware address of the device you want to configure.

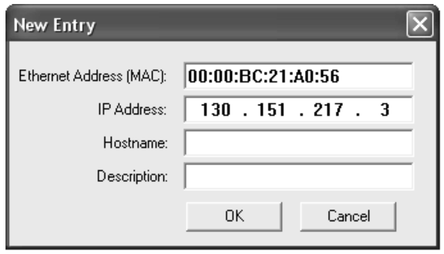
The hardware address is on the sticker located on the left-side circuit board of the controller next to the battery. The hardware address will be in this format: 00-0b-db-14-55-35.



6. The New Entry window appears with the device's Ethernet Address (MAC).

7. Enter the Ethernet address, IP address.

8. Click OK



9. To permanently assign this configuration to the device, highlight the device and click on the Disable BOOTP/DHCP button. When power is recycled, the device uses the configuration you assigned and not issue a BOOTP request.

If you do not select the Disable BOOTP/DHCP button, on a power cycle, the controller clears the current IP configuration and will again begin sending BOOTP requests.

Other methods to assign network parameters include:

Table 3.2

If you are working in these conditions:	Use this method for assigning network parameters:	See page:
• a BOOTP server is not available • connected to the controller through the serial port	RSLinx software	3-4
• the RSLogix 5000 project is online with the controller that communicates to or through the EtherNet/IP module	RSLogix 5000 software	3-5

If you use the Rockwell Automation BOOTP or DHCP server in an uplinked subnet where an enterprise DHCP server exists, a module may get an address from the enterprise server before the Rockwell Automation utility even sees the module. You might have to disconnect from the uplink to set the address and have the module remember its static address before reconnecting to the uplink. This is not a problem if you have node names configured in the module and leave DHCP enabled.

Using RSLinx software to set the IP address

You need RSLinx software, version 2.41 or higher.

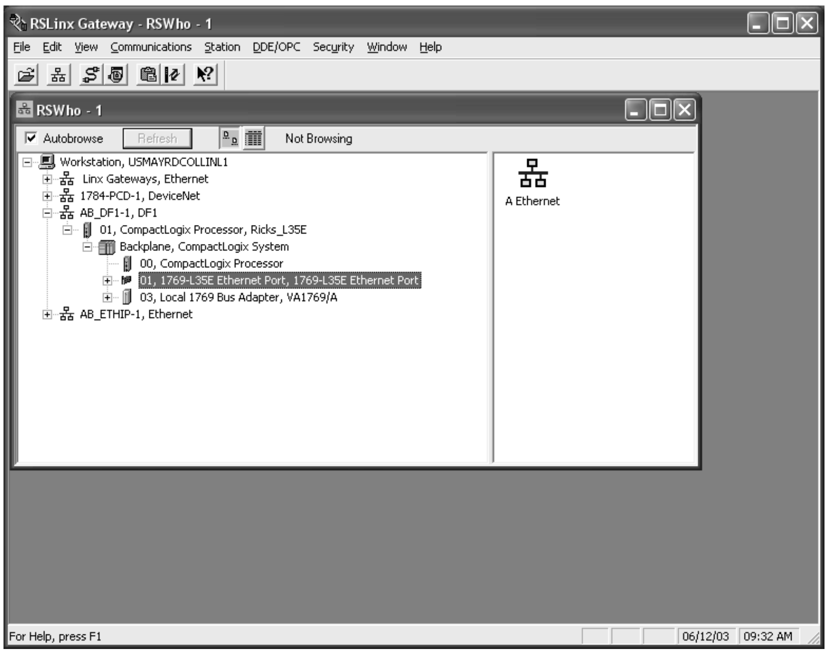
1. Make sure the controller that uses the IP address is installed and running.

2. Make a serial connection to the controller via the CH0 serial connector. You might also need to use RSLinx software to create a DF1 driver for the workstation. See Chapter 7 for more information.

3. Start RSLinx. The RSWho window opens.

4. Navigate in RSWho to the Ethernet network.

5. Right-click on the Ethernet port (not the controller) and select Module Configuration



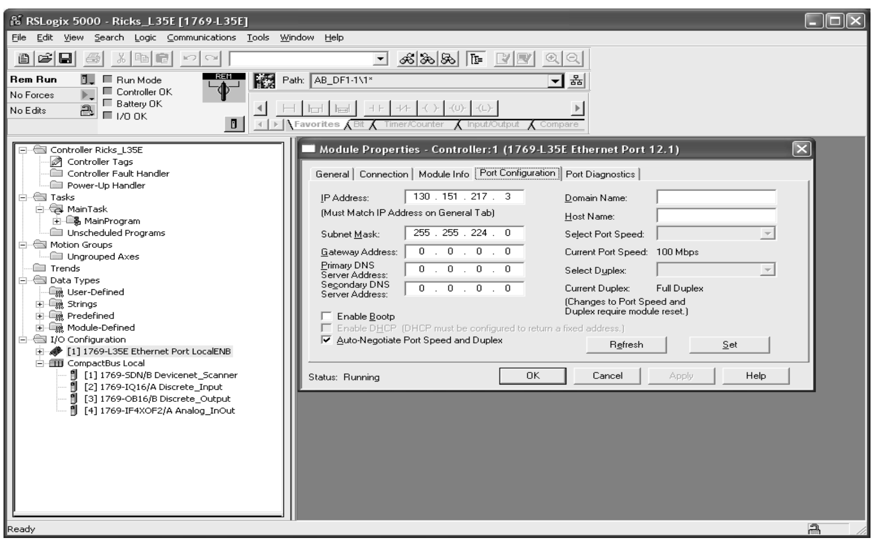
6. Select the Port Configuration tab, choose Status Network Configuration type, and enter the IP address, network (subnet) mask, and gateway address (if needed).

7. Also, select the Static radio button to permanently assign this configuration to the port. If you select Dynamic, on a power cycle, the controller clears the current IP configuration and will again begin sending BOOTP requests.

Using RSLogix 5000 software to set the IP address

IMPORTANT	Before you can us RSLogix 5000 software to assign an IP address, the controller must have valid firmware loaded. For information on locating and loading firmware, see page 1-4.

1. Make sure the controller that uses the IP address is installed and running.
2. Make a serial connection to the controller via the CH0 serial connector. You might also need to use RSLinx software to create a DF1 driver for the workstation. See Chapter 7 for more information.
3. Start RSLogix 5000 software.
4. Go online.
5. In the Controller Organizer, select properties for the Ethernet port.



6. Select the Port Configuration tab and specify the IP address and click Apply.
7. Click OK.

This sets the IP address in the hardware. This IP address should be the same IP address you assigned under the General tab.

From the Module Properties for the Ethernet port, you can also set a permanent port speed and duplex setting.

Step 2: Configuring the Ethernet communications driver

You need to load an Ethernet communications driver for a personal computer to communicate with other devices on an EtherNet/IP network. A personal computer only needs this driver if you use the personal computer to:

- upload and download controller projects over EtherNet/IP via RSLogix 5000 programming software
- configure EtherNet/IP network parameters for devices on the network via RSNetWorx for EtherNet/IP software

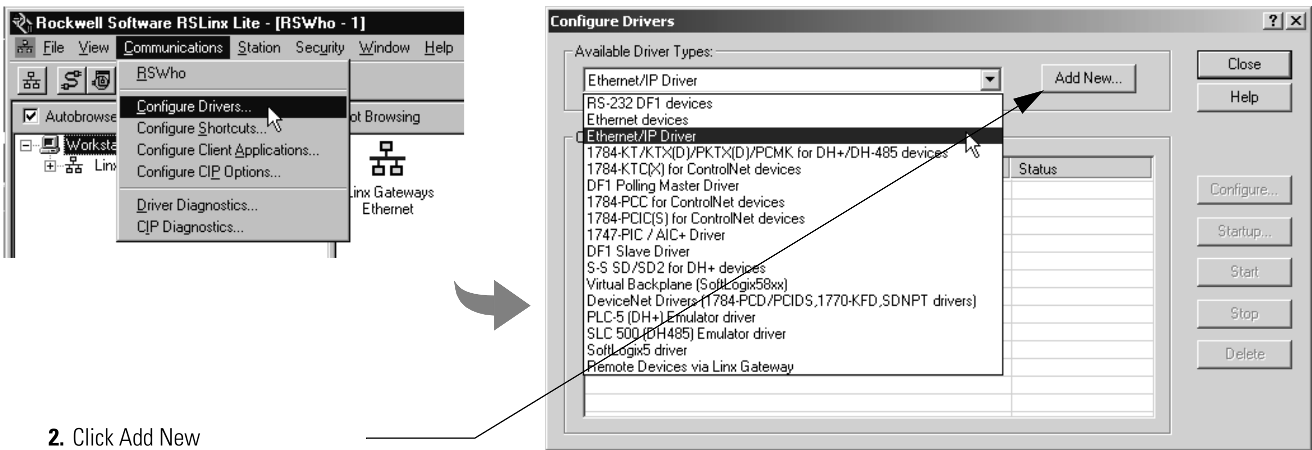
Before you load a communication driver, make sure the:

- Ethernet communication card has already installed in the personal computer
- IP address and other network parameters have been correctly configured for the personal computer
- personal computer is properly connected to the EtherNet/IP network

See the documentation for the Ethernet communications card for information on installing and configuring the card.

To configure the Ethernet communication driver, do the steps shown below:

1. In RSLinx software, select Configure Driver. Select “Ethernet/IP Driver”.

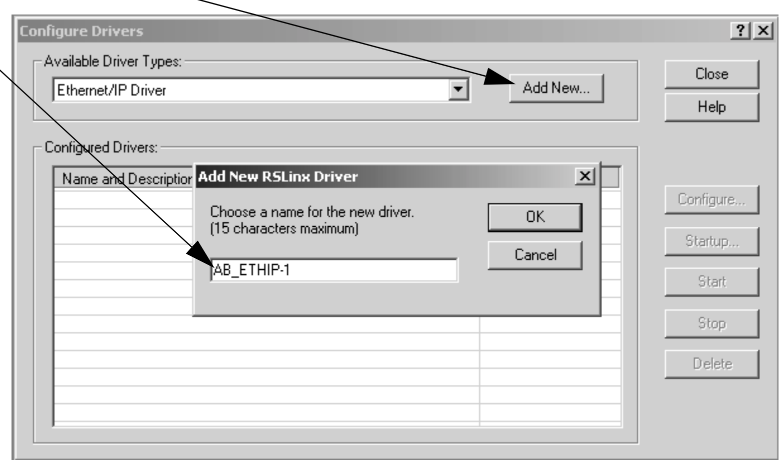


2. Click Add New

3. Click Add New to add the driver.

4. Type a name for the driver.

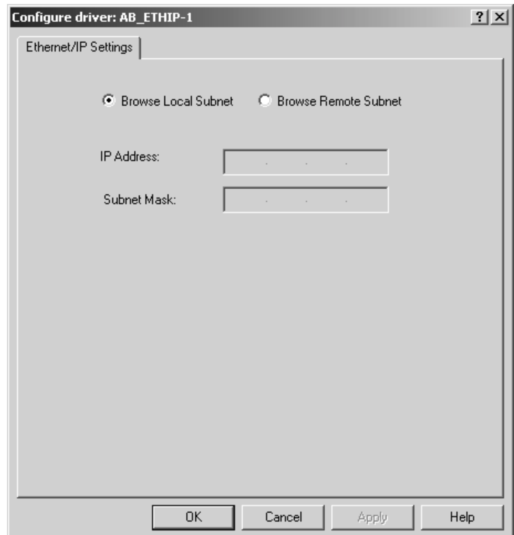
5. Click OK.



continued

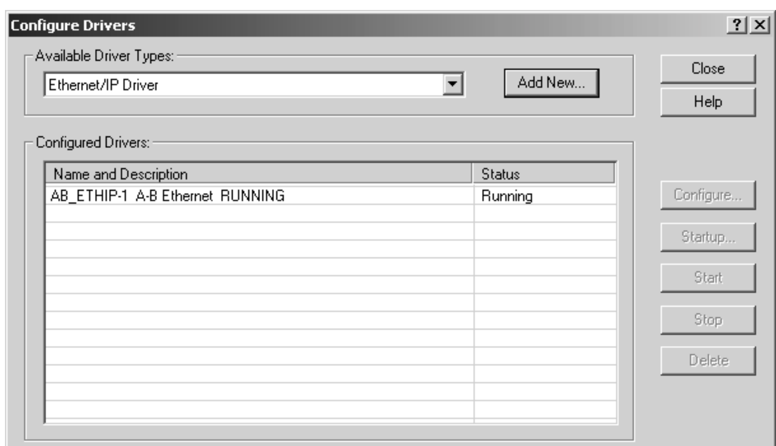
After you create the driver, configure it to correspond to the Ethernet port on the controller.

1. Select where the EtherNet/IP devices reside. The software locates valid IP addresses.



2. Click OK

3. The driver is now available and you can select the Ethernet port from Who Active in RSLogix 5000 programming software.



You can also use the Ethernet Devices driver type. However, if you choose this driver, you must manually enter the device's IP address.

Controller Connections Over EtherNet/IP

A Logix system uses a connection to establish a communication link between two devices. Connections can be:

- controller to distributed I/O or remote adapter
- produced and consumed tags
- messages

You indirectly determine the number of connections the controller uses by configuring the controller to communicate with other devices in the system. Connections are allocations of resources that provide more reliable communications between devices than unconnected messages.

All EtherNet/IP connections are unscheduled. An unscheduled connection is a message transfer between controllers that is triggered by the requested packet interval (RPI) or the program (such as a MSG instruction). Unscheduled messaging lets you send and receive data when needed.

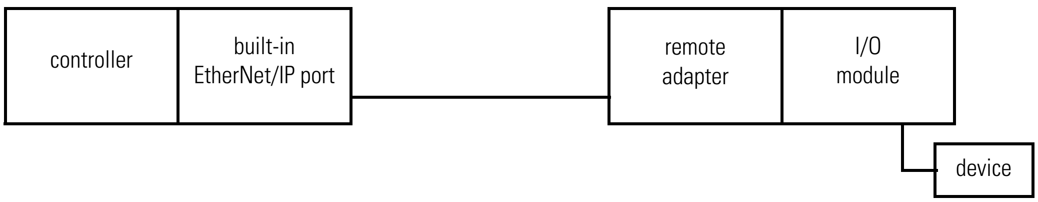
The 1769-L32E and 1769-L35E controller each supports 32 CIP connections over an EtherNet/IP network.

Configuring Distributed I/O

The CompactLogix controller supports distributed I/O over a EtherNet/IP link. Configuring I/O in a remote chassis is similar to configuring local I/O. You create the remote adapter and distributed I/O modules on the local Ethernet port.

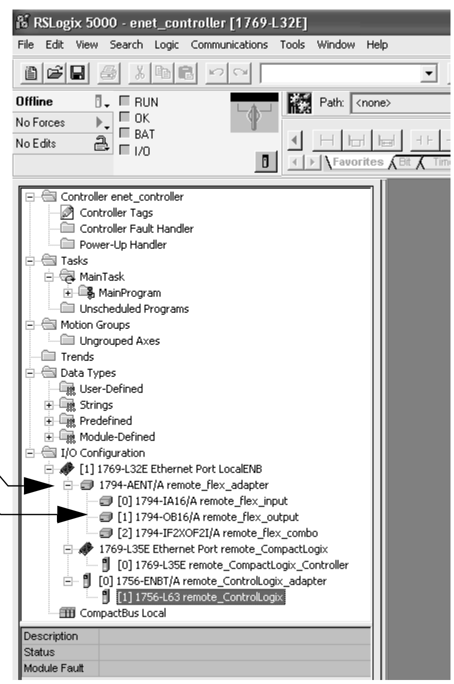
To communicate with distributed I/O modules, add a remote adapter and I/O modules to the I/O Configuration folder of the controller.

For a typical CompactLogix distributed I/O network…



…you build the I/O configuration in this order

1. Add the remote adapter to the EtherNet/IP port of the controller.
2. Add the I/O modules to the remote adapter.



Accessing distributed I/O

I/O information is presented as a structure of multiple fields, which depend on the specific features of the I/O module. The name of the structure is based on the location of the I/O module in the system. Each I/O tag is automatically created when you configure the I/O module through the programming software. Each tag name follows this format:

Location:SlotNumber:Type.MemberName.SubMemberName.Bit

where:

Table 3.3

This address variable:	Is:
Location	Identifies network location LOCAL = local DIN rail or chassis ADAPTER_NAME = identifies remote adapter or bridge
SlotNumber	Slot number of I/O module in its chassis
Type	Type of data I = input O = output C = configuration S = status
MemberName	Specific data from the I/O module; depends on the type of data the module can store For example, Data and Fault are possible fields of data for an I/O module. Data is the common name for values the are sent to or received from I/O points.
SubMemberName	Specific data related to a MemberName.
Bit (optional)	Specific point on the I/O module; depends on the size of the I/O module (0-31 for a 32-point module)

EXAMPLE

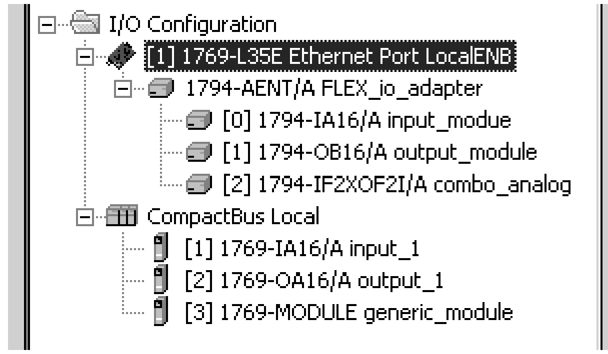


Table 3.4

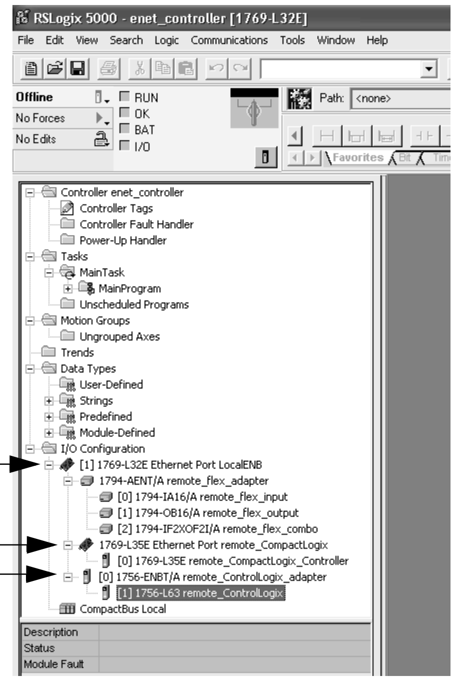
Device:	**Example Tag Names (automatically created by the software):**
remote adapter “FLEX_io_adapter”	FLEX_io_adapter:I FLEX_io_adapter:I.SlotStatusBits FLEX_io_adapter:I.Data FLEX_io_adapter:O FLEX_io_adapter:O.Data
remote “input_module” in slot 0 rack-optimized connection	FLEX_io_adapter:0:C FLEX_io_adapter:0:C.Config FLEX_io_adapter:0:C.DelayTime_0 FLEX_io_adapter:0:C.DelayTime_1 FLEX_io_adapter:0:C.DelayTime_2 FLEX_io_adapter:0:C.DelayTime_3 FLEX_io_adapter:0:C.DelayTime_4 FLEX_io_adapter:0:C.DelayTime_5 FLEX_io_adapter:0:I
remote “output_module” in slot 1 rack-optimized connection	FLEX_io_adapter:1:C FLEX_io_adapter:1:C.SSData FLEX_io_adapter:1:O FLEX_io_adapter:1:O.Data
remote “combo_analog” in slot 2 direct connection	FLEX_io_adapter:2:C FLEX_io_adapter:2:C.InputFIlter FLEX_io_adapter:2:C.InputConfiguration FLEX_io_adapter:2:C.OutputConfiguration FLEX_io_adapter:2:C.RTSInterval FLEX_io_adapter:2:C.SSCh0OuputData FLEX_io_adapter:2:C.SSCH1OutputData FLEX_io_adapter:2:I

Adding a Remote Controller

If you want to add the controller as a remote consumed controller to the I/O configuration, you first add the EtherNet/IP port and then the controller.

To add a remote controller, you build the I/O configuration in this order

1. You add devices to the EtherNet/IP port of the controller.
2. Add a CompactLogix controller. The software adds the EtherNet/IP port.
3. For a controller that requires a communication module, add the module first and then add the controller.



Producing and Consuming Data

The 1769-L32E and 1769-L35E controller supports the ability to produce (broadcast) and consume (receive) system-shared tags over an EtherNet/IP link. Produced and consumed data is accessible by multiple controllers over an Ethernet network. The controller sends or receives data at a predetermined RPI rate. This is the recommended method of communication between Logix controllers.

Produced and consumed tags must be of DINT or REAL data type or a structure. You can use a user-defined structure to group BOOL, SINT, and INT data to be produced.

Table 3.5

Tag type:	Description:	Specify:
produced	These are tags that the controller produced for other controllers to consume.	• Enabled for producing • How many consumers allowed
consumed	These are tags whose values are produced by another controller.	• Controller name that owns the tag that the local controller wants to consume • Tag name or instance that the controller wants to consume • Data type of the tag to consume • Update interval of how often the local controller consumes the tag

The producer and consumer must be configured correctly for the specified data to be shared. A produced tag in the producer must be specified exactly the same as a consumed tag in the consumer.

If any produced/consumed tag between a producer and consumer is not specified correctly, none of the produced/consumed tags for that producer and consumer will be transferred. For example, if a CompactLogix controller is consuming three tags that another controller produces but the first tag is specified incorrectly, none of the tags are transferred to the consuming CompactLogix controller.

However, one consumer failing to access shared data does not affect other consumers accessing the same data. For example, if the producing CompactLogix controller from the previous example also produced tags for other consuming controllers but did so correctly, those tags are still transferred to the additional consuming controllers.

Maximum number of produced and consumed tags

The maximum number of produced/consumed tags that you can configure depends on the connection limits of the Ethernet port on the controller. You can have a maximum of 32 connections through the Ethernet port.

Each produced tag uses one connection for the tag and the first configured consumer of the tag. Each consumer thereafter uses an additional connection.

If you have a lot of data to produce or consume, organize that data into an array. An array is treated as one tag, so it uses only one connection.

Size limit of a produced or consumed tag

A produced or consumed tag can be as large as 488 bytes, but it must also fit within the bandwidth of the EtherNet/IP network.

Producing a tag

Produced data must be of DINT or REAL data type or a structure. You can use a user-defined structure to group BOOL, SINT, and INT data to be produced. To create a produced tag:

1. You must be programming offline.
2. In the controller organizer, double-click the Controller Tags folder and then click the Edit Tags tab.
3. Select the tag that you want to produce, or enter a new tag, and display the Tag Properties dialog box.
4. Make sure the tag is controller scope.
5. Select the "Produce this tag" check box. Specify how many controllers can consume the tag.

You can produce a base or alias tag. The consumed tag in a receiving controller must have the same data type as the produced tag in the originating controller. The controller performs type checking to ensure proper data is being received.

Consuming a tag

A consumed tag represents data that is produced (broadcast) by one controller and received and stored by the consuming controller. To create a consumed tag:

1. You must be programming offline.
2. In the controller organizer, double-click the Controller Tags folder and then click the Edit Tags tab.
3. Select the tag that you want to consume, or enter a new tag, and display the Tag Properties dialog box.
4. Specify the information in Table 3.6:

Table 3.6

In this field:	Type or select:
Tag Type	Select Consumed.
Controller	Select the name of the other controller. You must have already created the controller in the controller organizer for the controller name to be available.
Remote Tag Name Remote Instance	Type a name for the tag in the other controller you want to consume. **Important:** The name must match the name in the remote controller exactly, or the connection faults.
RPI (requested packet interval)	Type the amount of time in msec between updates of the data from the producing controller. The consuming controller will receive data at least this fast. Virtual-backplane controllers, such as CompactLogix and FlexLogix controllers, only produce data at RPIs in powers of two milliseconds (such as 2, 4, 8, 16, 32, 64, etc.), or when triggered by an IOT instruction.
Display Style	If you are creating a consumed tag that refers to a tag whose data type is BOOL, SINT, INT, DINT, or REAL, you can select a display style. This display style defines how the tag value will be displayed in the data monitor and ladder editor. The display style does not have to match the display style of the tag in the remote controller.

All consumed tags are automatically controller-scope. The produced tag in the originating CompactLogix controller must have the same data type as the consumed tag in the consuming controller. The CompactLogix controller performs type checking to make sure proper data is being received.

IMPORTANT If a consumed-tag connection fails, none of the tags are transferred from the producing controller to the consuming controller.

Sending Messages

The CompactLogix controller can send MSG instructions to other controllers and devices over an EtherNet/IP link. Each MSG instruction requires you to specify a target and an address within the target.

MSG instructions are unscheduled. The type of MSG determines whether or not it requires a connection. If the MSG instruction requires a connection, it opens the needed connection when it is executed. You can configure the MSG instruction to keep the connection open (cache) or to close it after sending the message.

Table 3.7

This type of MSG:	Using this communication method:	Uses a connection:	Which you can cache:
CIP data table read or write	CIP	X	X
PLC-2, PLC-3, PLC-5, or SLC (all types)	CIP	X	X
	CIP with Source ID	X	X
	DH+	X	
CIP generic	CIP	X[1]	X
block-transfer read or write	na	X	X

(1) You can connect CIP generic messages, but for most applications, we recommend you leave CIP generic messages unconnected.

IMPORTANT The update time of local I/O modules may increase when the controller is bridging messages.

Bridging over the CompactLogix controller should be targeted toward applications that are not real time dependent, such as RSLogix 5000 program downloads and ControlFlash updates.

Communicating with another Logix-based controller

All Logix-based controllers can use MSG instructions to communicate with each other. The following examples show how to use tags in MSG instructions between Logix-based controllers.

Table 3.8

Type of MSG Instruction:	Example Source and Destination:	
Logix-based controller writes to Logix-based controller (CIP Data Table Write)	source tag destination tag	*array_1* *array_2*
Logix-based controller reads from Logix-based controller (CIP Data Table Read)	source tag destination tag	*array_1* *array_2*

The source and destination tags:

- must be controller-scoped tags.
- can be of any data type, except for AXIS, MESSAGE, or MOTION_GROUP.

Communicating with other controllers over EtherNet/IP

The CompactLogix controller also uses MSG instructions to communicate with PLC and SLC controllers. The MSG instructions differ depending on which controller initiates the instruction.

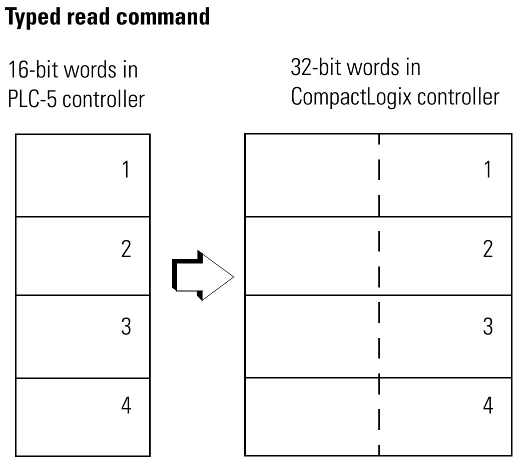
For MSG instructions originating from a CompactLogix controller to a PLC or SLC controller:

Table 3.9

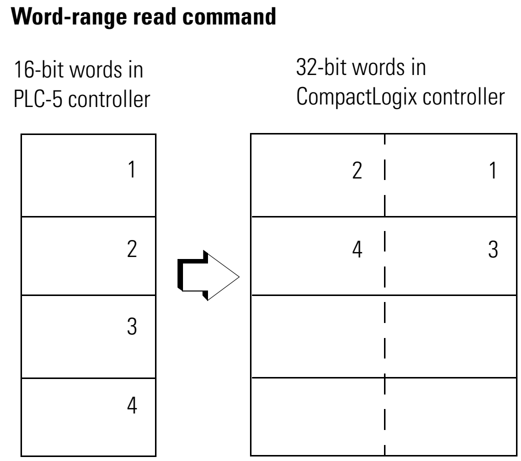
Type of MSG Instruction:	Supported Source File Types:	Supported Destination File Types:
CompactLogix writes to PLC-5 or SLC	In the CompactLogix controller, specify the source data type based on the destination device: PLC-5: SINT, INT, DINT, or REAL SLC: INT, REAL Example source element: *array_1*	Specify the destination file type based on the destination device: PLC-5 typed write: S, B, N, or F PLC-5 word-range write: S, B, N, F, I, O, A, or D SLC: B, N or F Example destination tag: *N7:10*
CompactLogix writes to PLC-2	In the CompactLogix controller, select one of these data types: SINT, INT, DINT, or REAL Example source element: *array_1*	Use the PLC-2 compatibility file. Example destination tag: *010*
CompactLogix reads from PLC-5 or SLC	Specify the destination file type based on the destination device: PLC-5 typed read: S, B, N, or F PLC-5 word-range read: S, B, N, F, I, O, A, or D SLC: B, N or F Example source element: *N7:10*	In the CompactLogix controller, specify the destination data type based on the destination device: PLC-5: SINT, INT, DINT, or REAL SLC: INT, REAL Example destination tag: *array_1*
CompactLogix reads from PLC-2	Use the PLC-2 compatibility file. Example source element: *010*	In the CompactLogix controller, select one of these data types: SINT, INT, DINT, or REAL Example destination tag: *array_1*

The CompactLogix controller can send typed or word-range commands to PLC-5 controllers. These commands read and write data differently. The diagrams in Figure 3.1 show how the typed and word-range commands differ.

Figure 3.1



The typed commands maintain data structure and value.



The word-range commands fill the destination tag contiguously. Data structure and value change depending on the destination data type.

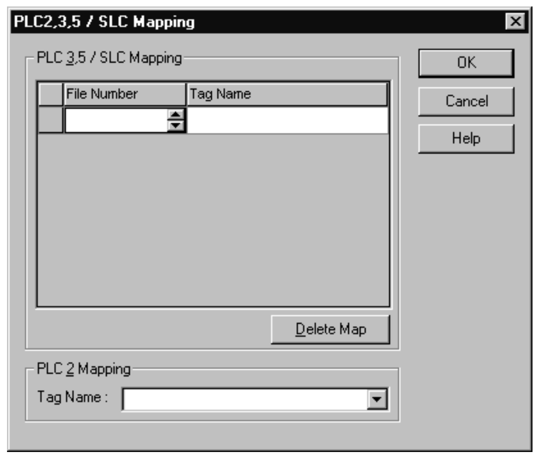
The CompactLogix controller can process messages initiated from PLC or SLC controllers. These messages use data table addresses. In order for these controllers to access tags within the CompactLogix controller, you map tags to data table addresses.

Mapping addresses

The programming software includes a PLC/SLC mapping tool which allows you to make an existing controller array tag in the local controller available to PLC-2, PLC-3, PLC-5, or SLC controllers.

To map addresses:

1. From the Logic menu, select Map PLC/SLC Messages.



2. Specify the information listed in Table 3.10:

Table 3.10

For:	In this field:	Specify:	For example:
PLC-3, PLC-5, and SLC controllers	File Number	Type the file number of the data table in the PLC/SLC controller.	*10*
	Tag Name	Type the array tag name the local controller uses to refer to the PLC/SLC data table address. The tag must be an integer array (SINT, INT, or DINT) that is large enough for the message data.	*array_1*
PLC-2 controllers	Tag Name	Type the tag name to be the PLC-2 compatibility file.	*200*

TIP You can map as many tags as you want to a PLC-3, PLC-5, or SLC controller. You can map only one tag to a PLC-2 controller.

Table 3.11 shows example source and destination tags and elements for different controller combinations.

Table 3.11

Type of MSG Instruction:	Example Source and Destination:	
PLC-5 writes to CompactLogix SLC writes to CompactLogix SLC 5/05 SLC 5/04 OS402 and above SLC 5/03 OS303 and above	source element	*N7:10*
	destination tag	*"array_1"*
	The PLC-5, PLC-3, and SLC controllers support logical ASCII addressing so you do not have to map a compatibility file for MSG instructions initiated by a PLC-5, PLC-3, or SLC controller. Place the CompactLogix tag name in double quotes ("). You could optionally map a compatibility file. For example, if you enter *10* for the compatibility file, you enter *N10:0* for the destination tag.	
PLC-2 writes to CompactLogix	source element	*010*
	destination tag	*200*
	The destination tag is the three-digit PLC-2 address you specified for PLC-2 mapping.	
PLC-5 reads from CompactLogix SLC reads from CompactLogix SLC 5/05 SLC 5/04 OS402 and above SLC 5/03 OS303 and above	source tag	*"array_1"*
	destination element	*N7:10*
	The PLC-5, PLC-3, and SLC controllers support logical ASCII addressing so you do not have to map a compatibility file for MSG instructions initiated by a PLC-5, PLC-3, or SLC controller. Place the CompactLogix tag name in double quotes ("). You could optionally map a compatibility file. For example, if you enter *10* for the compatibility file, you enter *N10:0* for the source tag.	
PLC-2 reads from CompactLogix	source tag	*200*
	destination element	*010*
	The source tag is the three-digit PLC-2 address you specified for PLC-2 mapping.	

When the CompactLogix controller initiates messages to PLC or SLC controllers, you do not have to map compatibility files. You enter the data table address of the target device just as you would a tag name.

SLC 5/05 controllers, SLC 5/04 controllers (OS402 and above), and SLC 5/03 controllers (OS303 and above) support logical ASCII addressing and support PLC/SLC mapping (see the examples above). For all other SLC or MicroLogix1000 controllers, you must map a PLC-2 compatibility file (see the PLC-2 examples above).

Using a MSG Instruction to Send an Email

The controller is an email client that uses a mail relay server to send email. The CompactLogix controller can execute a CIP Generic message that sends an email message to a SMTP mail relay server using the standard SMTP protocol.

Some mail relay servers require a domain name be provided during the initial handshake of the SMTP session. For these mail relay servers, make sure you specify a domain name when you configure the network settings. See page 3-2 for information on configuring the network settings of the controller and specifying a domain name.

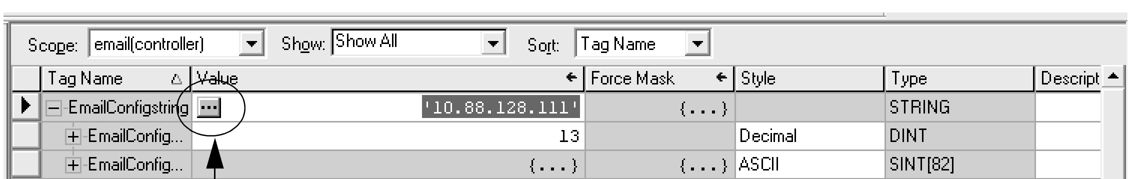
IMPORTANT	Be careful to write the ladder logic to ensure the MSG instructions are not continuously triggered to send email messages.

Step 1: Create string tags

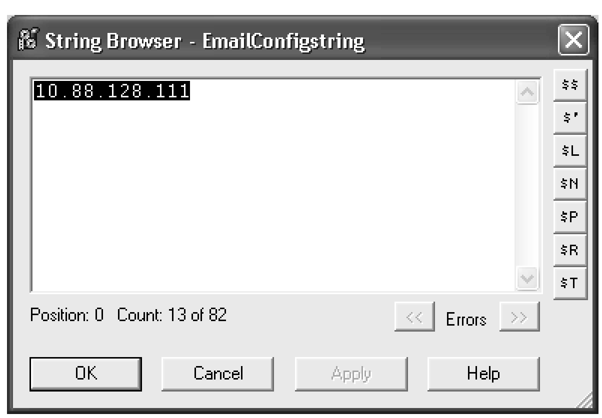
You need three string tags:

- one to identify the mail server
- one to contain the email text.
- one to contain the status of the email transmission

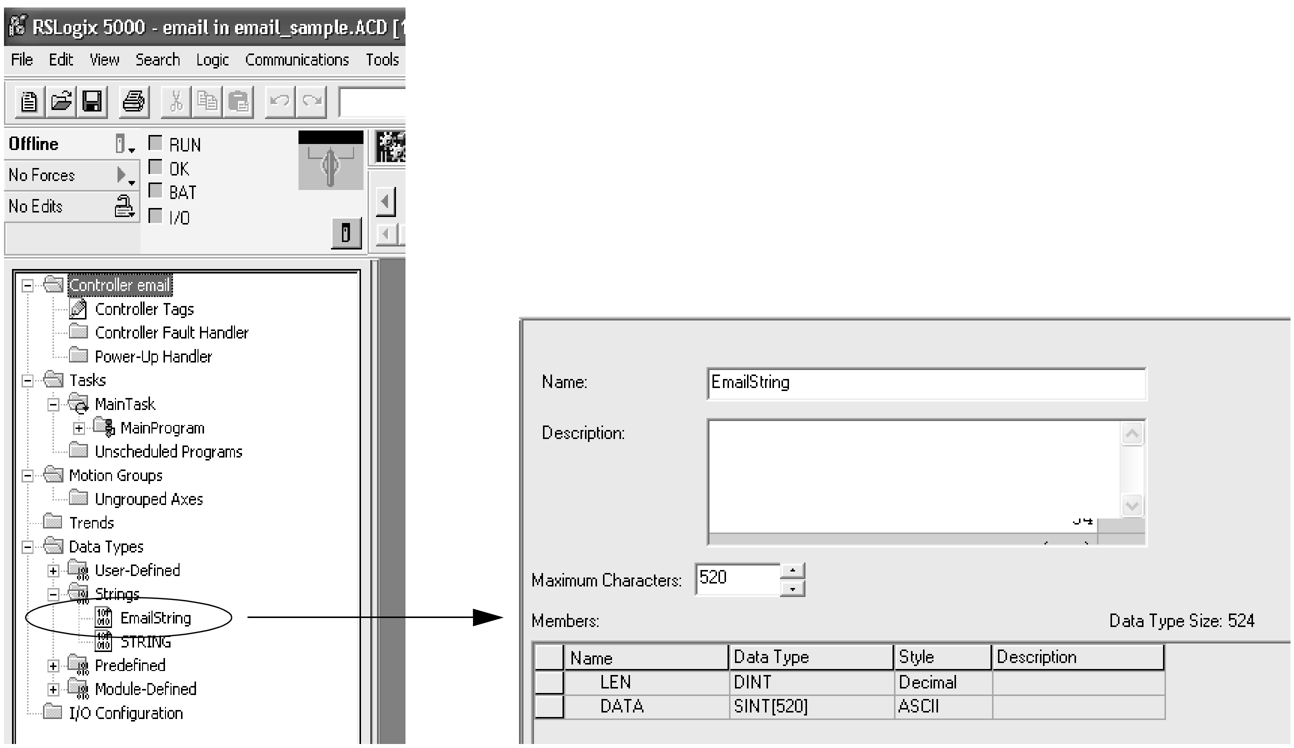
The default STRING data type supports as many as 82 characters. In most cases, this is sufficient to contain the address of the mail server. For example, create tag EmailConfigstring of type STRING:



1. Click in the Value box to display this button.
2. Click this button to display the String Browser so you can enter the IP address or host name of the mail server.



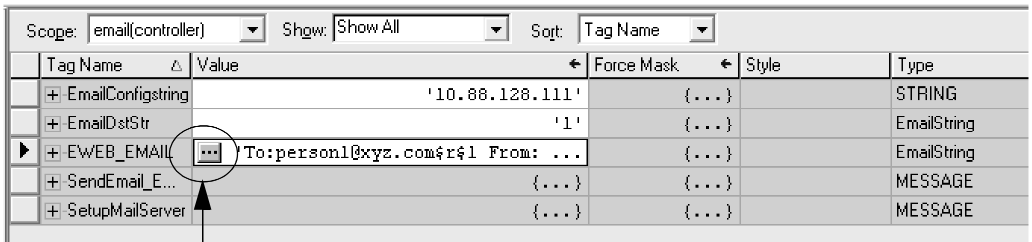
The tags for the email text and transmission status can contain as many as 474 characters. For these tags, you must create a user-defined STRING data type that is larger than the default. For example, create a STRING data type named EmailString.



Create one tag of this new data type to contain the email text. Create a second tag of this new data type to contain the transmission status. For example, create tag EWEB_EMAIL (to contain the email text) and EmailDstStr (to contain the transmission status). Both of these tags are of type EmailString.

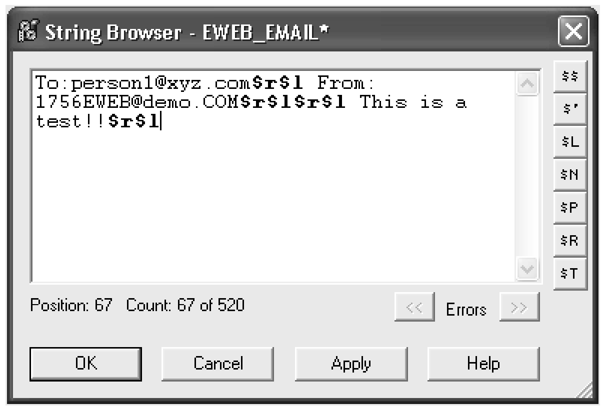
tag for status

tag for email text



1. Click in the Value box to display this button.

2. Click this button to display the String Browser so you can enter the IP address or host name of the mail server.

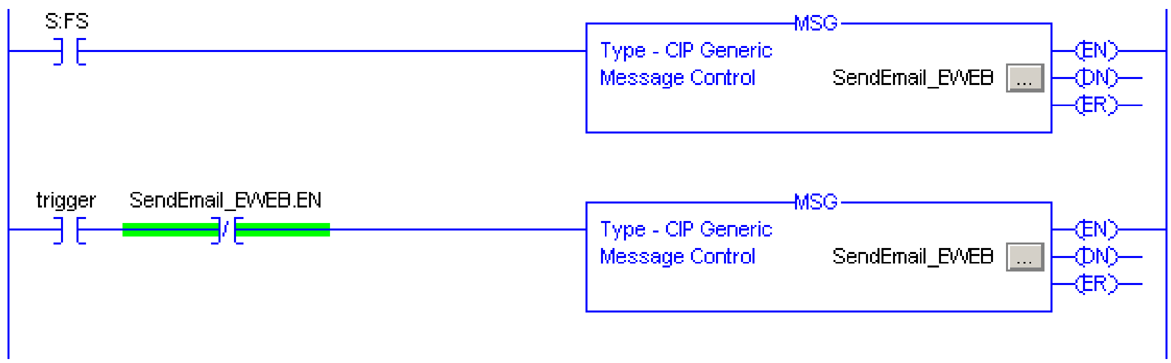


The text of the email does not have to be static. You can program a controller project to collect specific data to be sent in an email. For more information on using ladder logic to manipulate string data, see the *Logix5000 Controllers Common Procedures Programming Manual*, publication 1756-PM001.

See page 3-30 for details on entering email text.

Step 2: Enter the ladder logic

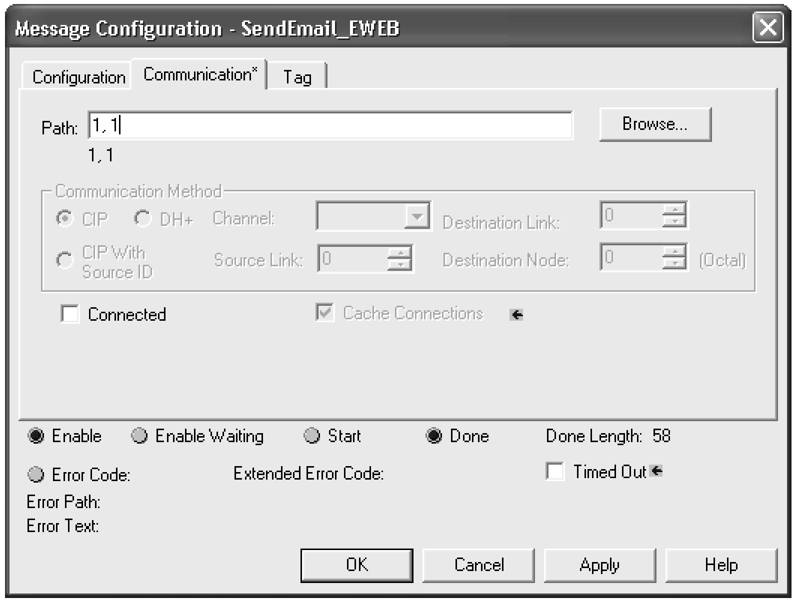
You need two MSG instructions. One MSG instruction configures the mail server. This only needs to be executed once. The next MSG instruction triggers the email. Execute this email MSG instruction as often as needed.



The first rung configures the mail server. The second rung sends the email text.

Step 3: Configure the MSG instruction that identifies the mail relay server

On the Communication tab of the MSG instruction, configure the path for the MSG instruction.



The path starts with the controller and specifies the Ethernet port of the 1769-L32E or 1769-L35E controller. In this example, the path is: 1, 1.

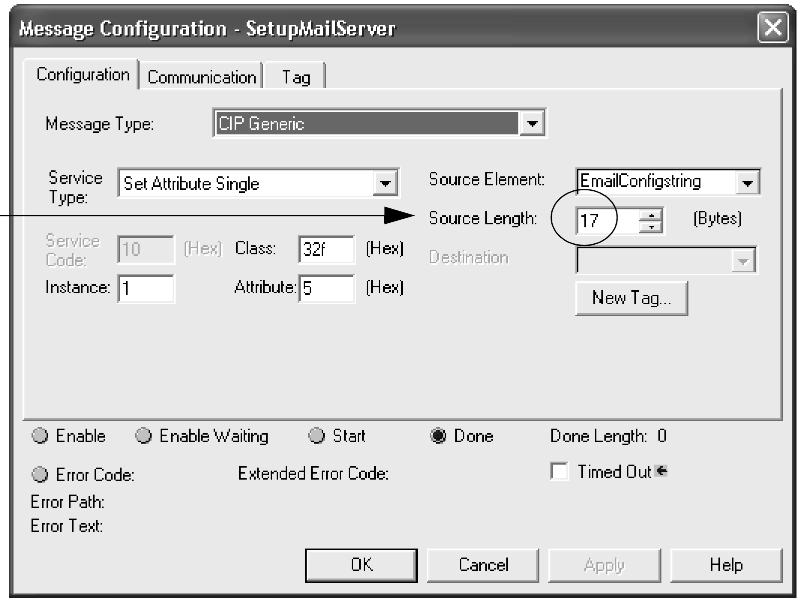
For more information on configuring the path of a MSG instruction, see the *Logix5000 Controllers General Instructions Reference Manual*, publication 1756-RM003.

On the Communication tab of the MSG instruction, configure the MSG parameters for identifying the mail relay server.

Some mail relay servers require a domain name be provided during the initial handshake of the SMTP session. For these mail relay servers, make sure you specify a domain name when you configure the network settings. See page 3-2 for information on configuring the network settings for the controller and specifying a domain name.

The Source Length is the number of characters in the STRING tag that identifies the mail relay server plus 4 characters.

In this example, the tag contains 13 characters.



where:

In this field:	Enter:
Service Type	Set Attribute Single
Instance	1
Class	32f
Attribute	5
Source Element	the STRING tag that contains the IP address or host name of the mail relay server In this example, enter EmailConfigstring
Source Length	the number of characters in the IP address or host name of the mail server plus 4 In this example, enter 17 (13 characters in the IP address 10.88.128.111 + 4)

After the MSG instruction that configures the mail relay server executes successfully, the controller stores the mail relay server information in non-volatile memory. The controller retains this information, even through power cycles, until another MSG instruction changes the information.

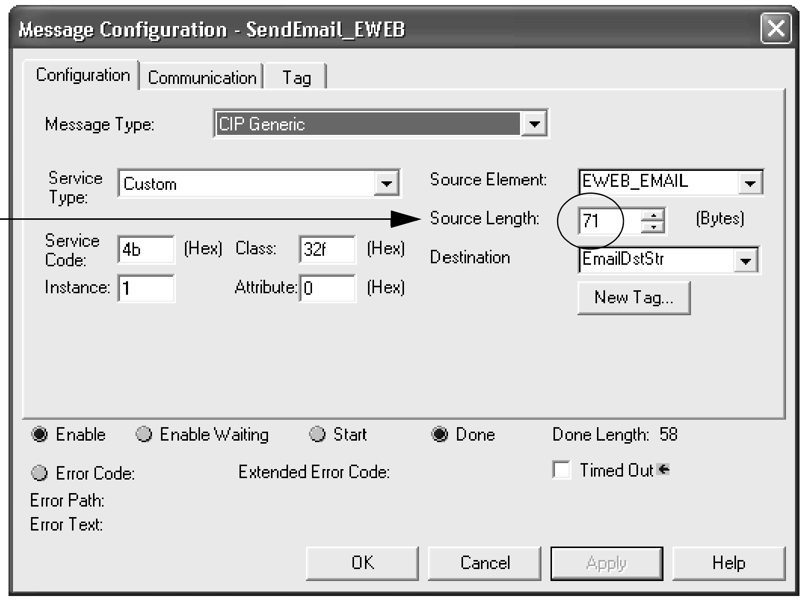
Step 4: Configure the MSG instruction that contains the email text

On the Communication tab of the MSG instruction, configure the path for the MSG instruction. This is the same as for the MSG instruction that identifies the mail relay server (see page 3-27).

On the Configuration tab of the MSG instruction, configure the MSG parameters for sending the email.

The Source Length is the number of characters in the email tag plus 4 characters.

In this example, the email text contains 67 characters, so the Source Length is 71.



where:

In this field:	Enter:
Service Type	Custom
Service Code	4b
Instance	1
Class	32f
Attribute	0
Source Element	the tag that contains the email text This tag is of the STRING data type you created to contain the email text. In this example, enter EWEB_EMAIL which is of type EmailString
Source Length	the number of characters in the email text plus 4 In this example, enter 71 (67 characters in the email + 4)
Destination	a tag to contain the status of the email transmission This tag is also of the STRING data type you created to contain the email text. In this example, enter EmailDstStr which is of type EmailString

Entering the text of the email

Use the string browser to enter the text of the email. In the example above, you enter the email text into the EWEB_EMAIL tag. To include "To:", "From:", and "Subject:" fields in the email, use <CR><LF> symbols to separate each of these fields. The "To:" and "From"" fields are required; the "Subject:" field is optional. Use a second set of <CR><LF> symbols after the last one of these fields you enter. For example:

> To: *email address of recipient* rl
> From: *email address of sender*rl
> Subject: *subject of message* rlrl
> *body of email message*

Use the "From" address to specify where the mail relay server can send an undeliverable email message.

The maximum length of an email message is 474 characters. An additional 4-byte string-length value is added to the tag. As a result, the maximum source length is 478 characters.

Possible email status codes

Examine the destination element of the email MSG to see whether the email was successfully delivered to the mail relay server. This indicates that the mail relay server placed the email message in a queue for delivery. It does not mean the intended recipient successfully received the email message. Possible codes that could be in this destination element are:

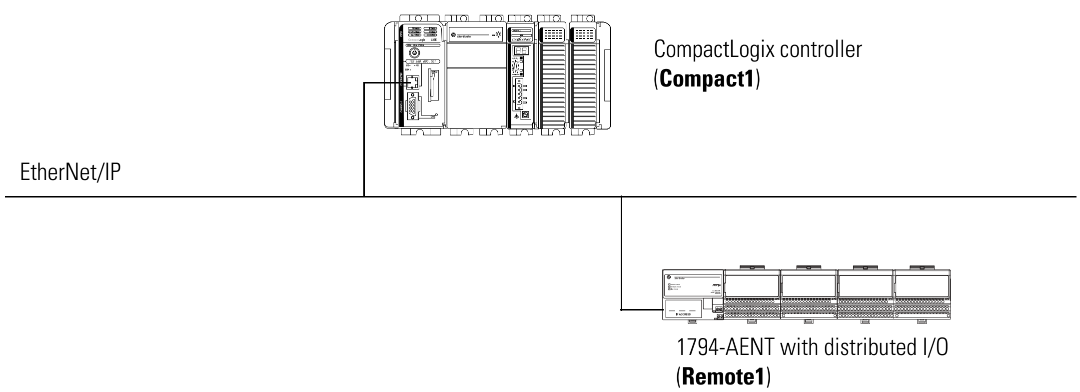
Table 3.12

Error Code (hex):	Extended-Error Code (hex):	Description:
0x00	none	Delivery successful to the mail relay server.
0x02	none	Resource unavailable. The email object was unable to obtain memory resources to initiate the SMTP session.
0x08	none	Unsupported Service Request. Make sure the service code is 0x4B and the Class is 0x32F.
0x11	none	Reply data too large. The Destination string must reserve space for the SMTP server reply message. The maximum reply can be 470 bytes.
0x13	none	Configuration data size too short. The Source Length is less than the Source Element string size plus the 4-byte length. The Source Length must equal the Source Element string size + 4.
0x15	none	Configuration data size too large. The Source Length is greater than the Source Element string size plus the 4-byte length. The Source Length must equal the Source Element string size + 4.
0x19	none	Data write failure. An error occurred when attempting to write the SMTP server address (attribute 4) to non-volatile memory.
0xFF	0x0100	Error returned by email server; check the Destination string for reason. The email message was not queued for delivery.
	0x0101	SMTP mail server not configured. Attribute 5 was not set with a SMTP server address.
	0x0102	"To:" address not specified. Attribute 1 was not set with a "To:" address AND there is not a "To:" field header in the email body.
	0x0103	"From:" address not specified. Attribute 2 was not set with a "From:" address AND there is not a "From:" field header in the email body.
	0x0104	Unable to connect to SMTP mail server set in Attribute 5. If the mail server address is a hostname, make sure that the device supports DNS, and that a Name Server is configured. If the hostname is not fully qualified, i.e., "mailhost" and not "mailhost.xx.yy.com" then the domain must be configured as "xx.yy.com". Try "ping <*mail server address*>" to insure the mail server is reachable from your network. Also try "telnet <*mail server address*> 25" which attempts to initiate a SMTP session with the mail server via telnet over port 25. (If you connect then enter "QUIT").
	0x0105	Communication error with SMTP mail server. An error occurred after the initial connection with the SMTP mail server. See the ASCII text following the error code for more details as to the type of error.
	0x0106	SMTP mail server host name DNS query did not complete. A previous send service request with a host name as the SMTP mail server address did not yet complete. Note that a timeout for a DNS lookup with an invalid host name can take up to 3 minutes. Long timeouts can also occur if a domain name or name server is not configured correctly.

Example 1: CompactLogix Controller and Distributed I/O

In the Figure 3.2 example, one CompactLogix controller controls distributed I/O through a 1794-AENT module.

Figure 3.2



Controlling distributed I/O

This example has Compact1 controlling the I/O connected to the remote 1794-AENT module. The data the CompactLogix controller receives from the distributed I/O modules depends on how you configure the I/O modules. You can configure each module as a direct connection or as rack optimized. One chassis can have a combination of some modules configured as a direct connection and others as rack optimized.

All analog modules require direct connections. Diagnostic modules support rack-optimized connections, but require direct connections to take full advantage of their diagnostic features.

Total connections required by Compact1

The following table calculates the connections used in this example.

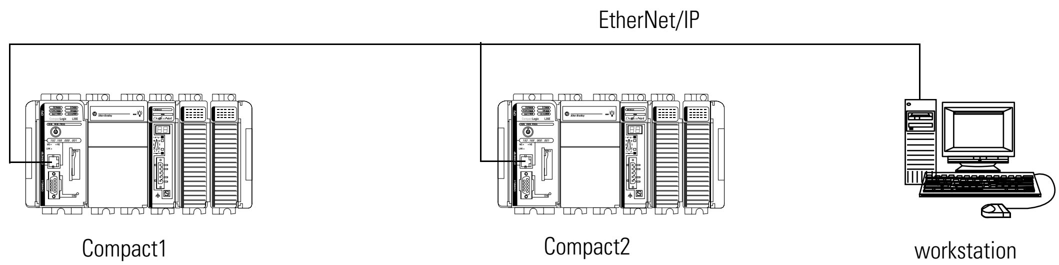
Connection:	Amount:
Compact1 to 4 distributed I/O modules (through 1794-AENT) • all I/O modules configured as direct connection • no connection to the 1794-AENT	4
total connections used:	4

If you configured the distributed I/O modules as rack-optimized, you would only need a rack-optimized connection to the 1794-AENT, reducing the above example by 3 connections.

Example 2: Controller to Controller

In the Figure 3.3 example, one EtherNet/IP CompactLogix controller communicates with another EtherNet/IP CompactLogix controller over EtherNet/IP. Each controller has its own local I/O.

Figure 3.3

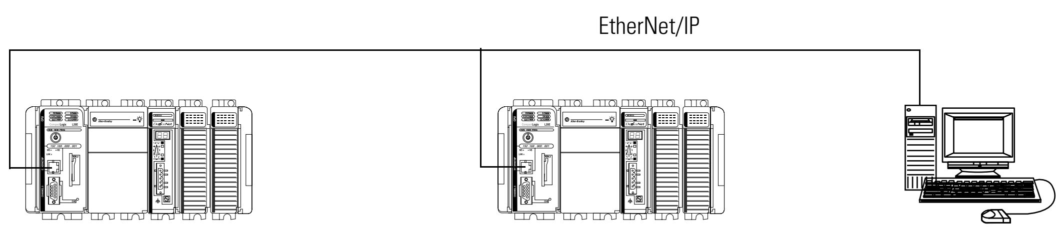


Producing and consuming tags

Produced data must be of DINT or REAL data type or an array or structure. You can use a user-defined structure to group BOOL, SINT, and INT data to be produced. You can produce a base, alias, or consumed tag.

The consumed tag must have the same data type as the produced tag in the originating controller. The controller performs type checking to ensure proper data is being received.

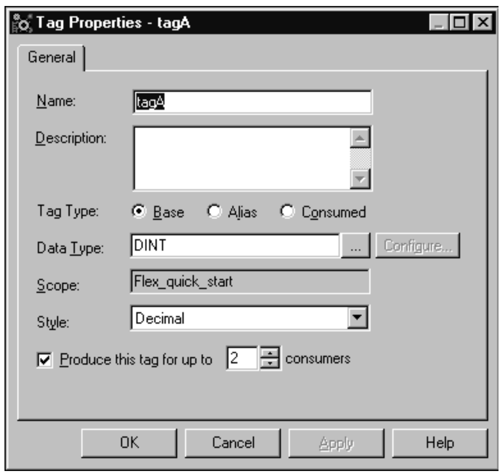
Figure 3.4



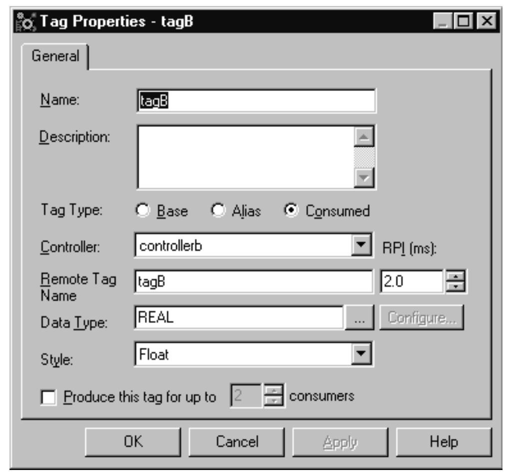
Compact1		**Compact2** (controllerb)		**workstation**
TagA	DINT	TagA	DINT	
TagB	REAL	TagB	REAL	

This example shows Compact1 as producing TagA and consuming TagB:

TagA



TagB



Each produced tags requires one connection for the producing controller and an additional connection for each consuming controller. Each consumed tag requires one connection.

Sending a MSG instruction

To send a MSG from Compact1 to Compact2:

1. For Compact1, create a controller-scoped tag and select the MESSAGE data type.

2. Enter a MSG instruction.

   In this example logic, a message is sent when a specific condition is met. When count_send is set, send count_msg.

3. Configure the MSG instruction. On the Configuration tab:

For this item:	Specify:
Message Type	CIP Data Table Read or CIP Data Table Write
Source Tag	Tag containing the data to be transferred
Number of Elements	Number of array elements to transfer
Destination Tag	Tag to which the data will be transferred

4. On the Communication tab, specify the communication path.

   Use the Browse button to select the device that will receive the MSG instruction. The communication path in this example is:

For this item:	Specify:
Communication Path	1,1,2,100.100.115.11,1,0 where: 1 is the virtual backplane of Compact 1 1 is the slot of the Ethernet port in the controller (note, the 1,1 displays as LocalENB) 2 is the EtherNet/IP network 100.100.115.11 is the IP address of Compact2 1 is the virtual backplane of Compact2 0 is the controller slot of Compact2

Total connections required by Compact1

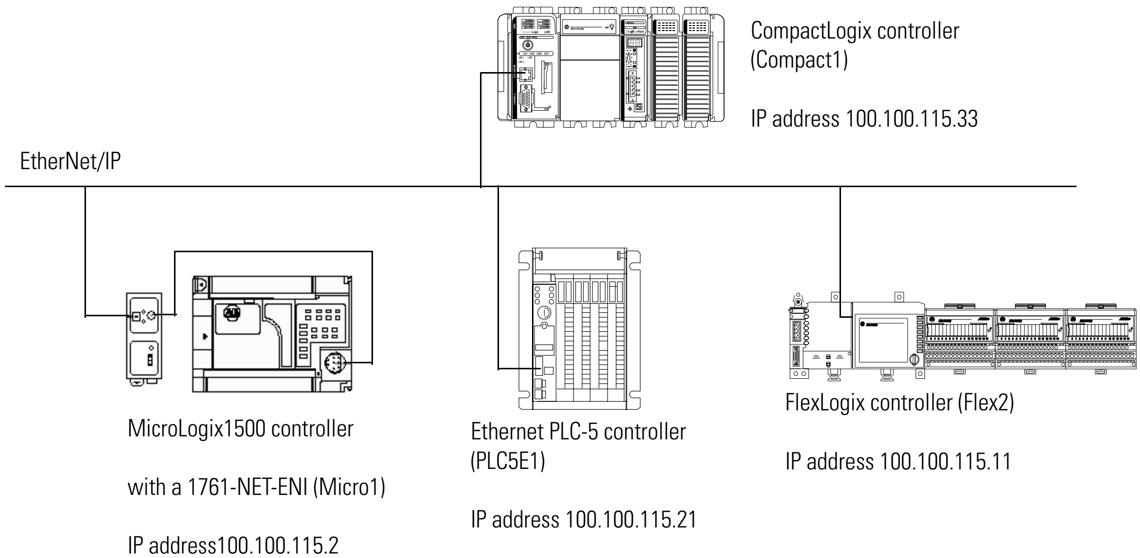
The following table calculates the connections used in this example.

Connection:	Amount:
connected, cached MSG from Compact1 to Compact2	1
produced TagA	
produced from Compact1 to Compact2	1
other consumer (2 are configured)	2
consumed TagB	1
total connections used:	5

Example 3: CompactLogix Controller to Other Devices

In the following example, one CompactLogix controller communicates with a MicroLogix 1500 controller, an Ethernet PLC-5 controller, and a FlexLogix controller over an EtherNet/IP network.

Figure 3.5



Sending a MSG instruction to another Logix-based controller

You configure a MSG instruction to other Logix-based controllers the same as you do for a CompactLogix controller. All Logix-based controllers follow the same MSG configuration requirements.

1. In the CompactLogix controller, create a controller-scoped tag and select the MESSAGE data type. Enter a MSG instruction. See Example 2 above for an example.

2. Configure the MSG instruction. On the Configuration tab:

For this item:	Specify:
Message Type	CIP Data Table Read or CIP Data Table Write
Source Tag	Tag containing the data to be transferred
Number of Elements	Number of array elements to transfer
Destination Tag	Tag to which the data will be transferred

3. On the Communication tab, specify the communication path.

   Use the Browse button to select the device that will receive the MSG instruction. The communication path in this example is:

For this item:	Specify:
Communication Path	1,1,2,100.100.115.11,1,0 where: 1 is the virtual backplane of Compact 1 1 is the slot of the Ethernet port in the controller (note, the 1,1 displays as LocalENB) 2 is the EtherNet/IP network 100.100.115.11 is the IP address of Flex2 1 is the virtual backplane of Flex2 0 is the controller slot of Flex2

Sending a MSG instruction to a PLC-5E processor

Configuring a MSG instruction for a PLC-5 processor requires different MSG configuration and PLC/SLC mapping.

1. In the CompactLogix controller, create a controller-scoped tag and select the MESSAGE data type. Enter a MSG instruction. See Example 2 above for an example.

2. Configure the MSG instruction. On the Configuration tab:

For this item:	Specify:
Message Type	PLC-5 Typed Read or PLC-5 Typed Write or PLC-5 Word Range Read or PLC-5 Word Range Write
Source Tag	Tag containing the data to be transferred
Number of Elements	Number of array elements to transfer
Destination Tag	Tag to which the data will be transferred

The source and destination data types depend on the message type you select:

Table 3.13

Type of Logix MSG instruction:	Source:	Destination:
PLC-5 Typed Read	any integer element (such as B3:0, T4:0.ACC, C5:0.ACC, N7:0, etc.)	SINT, INT, or DINT tag
	any floating point element (such as F8:0, PD10:0.SP, etc.)	REAL tag
PLC-5 Typed Write	SINT or INT tag	any integer element (such as B3:0, T4:0.ACC, C5:0.ACC, N7:0, etc.)
	REAL tag	any floating point element (such as F8:0, PD10:0.SP, etc.)
PLC-5 Word Range Read	any data type (such as B3:0, T4:0, C5:0, R6:0, N7:0, F8:0, etc.)	SINT, INT, DINT, or REAL
PLC-5 Word Range Write	SINT, INT, DINT, or REAL	any data type (such as B3:0, T4:0, C5:0, R6:0, N7:0, F8:0, etc.)

3. On the Communication tab, specify the communication path.

   Use the Browse button to select the device that will receive the MSG instruction. The communication path in this example is:

For this item:	Specify:
Communication Path	1,1,2,100.100.115.21 where: 1 is the virtual backplane of Compact 1 1 is the slot of the Ethernet port in the controller (note, the 1,1 displays as LocalENB) 2 is the EtherNet/IP network 100.100.115.21 is the IP address of PLC5E1

Sending a MSG instruction from a PLC-5E processor to a CompactLogix controller

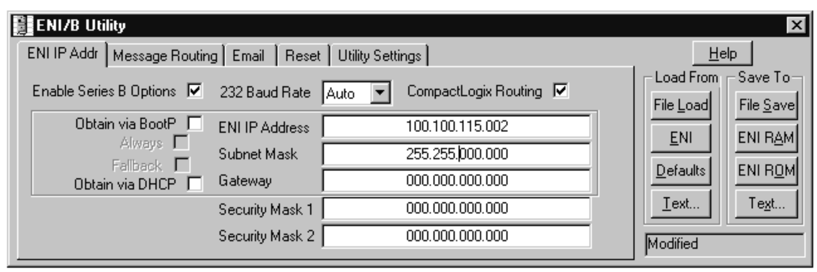
The PLC-5E processor supports logical ASCII addressing so you do not have to map a compatibility file for MSG instructions initiated by a PLC-5 processor. Place the CompactLogix tag name in double quotes (“).

Table 3.14

Type of MSG Instruction:	Example Source and Destination:	
PLC-5 writes to CompactLogix	source element	*N7:10*
	destination tag	*“array_1”*
PLC-5 reads from CompactLogix	source tag	*“array_1”*
	destination element	*N7:10*

Sending a MSG instruction to a MicroLogix 1500 controller with a 1761-NET-ENI module

1. Use the ENI utility to make sure the configuration for the 1761-NET-ENI module has the Enable Series B Options and CompactLogix Routing features enabled.



2. In the CompactLogix controller, create a controller-scoped tag and select the MESSAGE data type. Enter a MSG instruction. See Example 2 above for an example.

3. Configure the MSG instruction. On the Configuration tab:

For this item:	Specify:
Message Type	SLC Typed Read or SLC Typed Write
Source Tag	Tag containing the data to be transferred Make sure this tag is an INT
Number of Elements	Number of array elements to transfer
Destination Tag	Tag to which the data will be transferred

4. On the Communication tab, specify the communication path.

Use the Browse button to select the device that will receive the MSG instruction. The communication path in this example is:

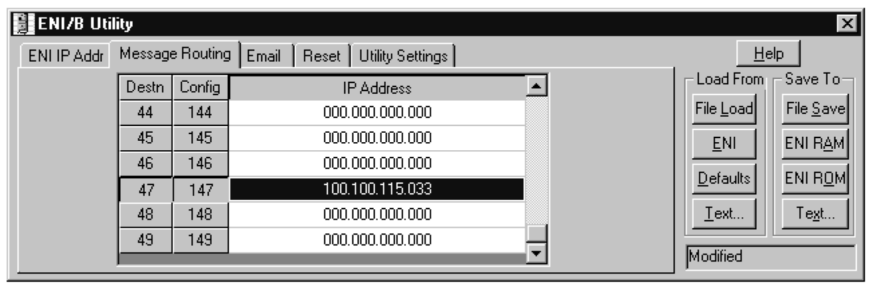
For this item:	Specify:
Communication Path	1,1,2,100.100.115.2 where: 1 is the virtual backplane of Compact 1 1 is the slot of the Ethernet port in the controller (note, the 1,1 displays as LocalENB) 2 is the EtherNet/IP network 100.100.115.2 is the IP address of Micro1

Sending a MSG instruction from a MicroLogix 1500 controller with a 1761-NET-ENI module to a CompactLogix controller

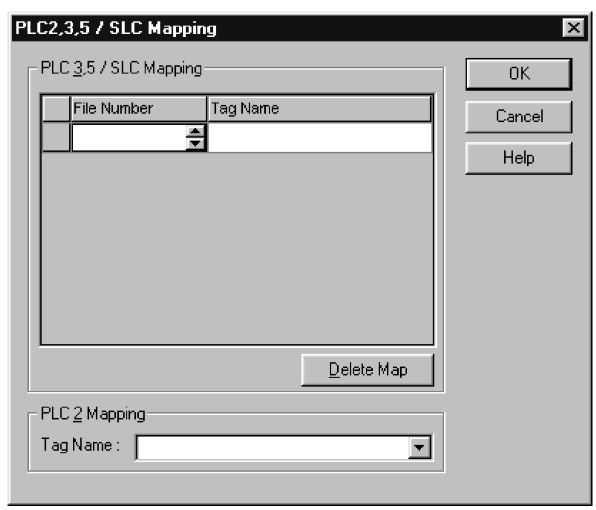
If the MSG instruction originates from the MicroLogix 1500 controller, make sure the configuration for the 1761-NET-ENI module can recognize the CompactLogix controller:

1. Use the ENI utility to make sure the configuration for the 1761-NET-ENI module has the Enable Series B Options and CompactLogix Routing features enabled.

2. Use the ENI utility to add the IP address of the CompactLogix controller to the configuration for the 1761-NET-ENI module. Assign the IP address of the CompactLogix controller to one of the Logix destination locations (45-49) on the Message Routing tab.



You must also map the logical address of the MicroLogix tag (i.e., N16) to a value (tag) in the CompactLogix controller. You can map the address in RSLogix 5000 while the project is offline.



a. Type the file number of the logical address in the MicroLogix controller.

b. Type or select the controller-scoped (global) tag in the CompactLogix controller that supplies or receives data for the file number. (You can map multiple files to the same tag.) This tag must be an INT tag.

Total connections required by Compact1

The following table calculates the connections used in this example.

Connection:	Amount:
connected, cached MSG from Compact1 to Flex2	1
connected, cached MSG from Compact1 to PLC-5E1	1
connected, cached MSG from Compact1 to Micro1	1
total connections used:	3

Example 4: Receiving Messages from Other Devices

When other devices send messages to the CompactLogix controller, the path for the message must identify the controller. Configure a CIP-type message in the originating device. Specify the path the CompactLogix controller as:

xxx.xxx.xxx.xxx,1,0

where:

xxx.xxx.xxx.xxx is the IP address of the controller

1 is the virtual backplane of controller

0 is the controller slot of the controller

Communicating with Devices on a ControlNet Link

Using This Chapter

The 1769-L35CR controller has a built-in ControlNet port that supports program upload/download, messaging, and distributed I/O over a ControlNet network.

Table 4.1

Configuring Your System for a ControlNet Link

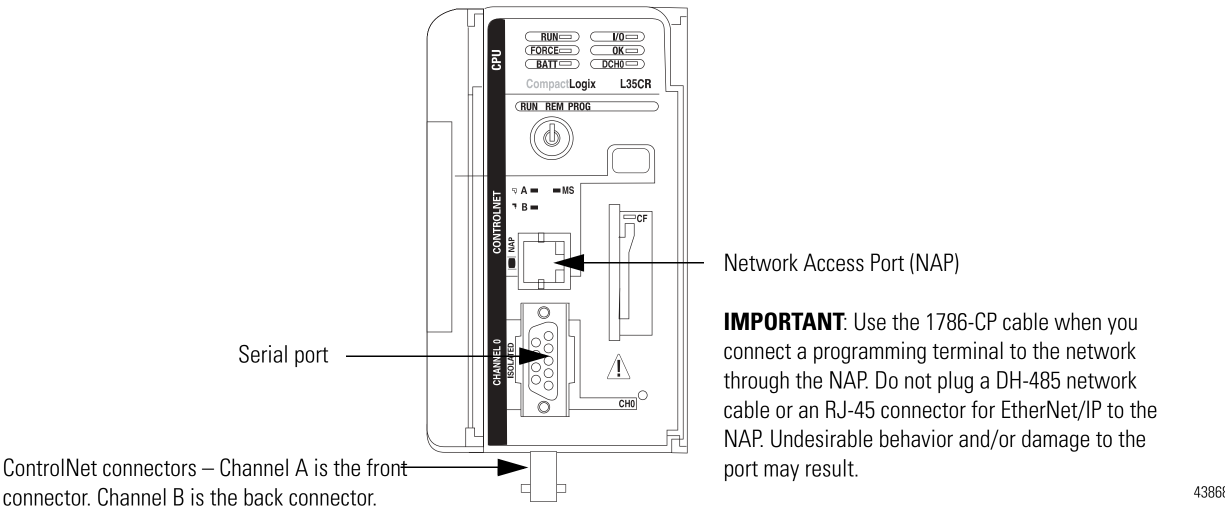
For the CompactLogix controller to operate on a ControlNet network, you need:

- a 1769-L35CR CompactLogix controller with valid firmware loaded. For more information on how to load firmware, see page 1-4.
- RSLinx software to configure the ControlNet communication driver
- RSLogix5000 programming software
- RSNetWorx for ControlNet software to schedule the CompactLogix system on the ControlNet network

Step 1: Configure the hardware

Figure 4.1 shows the 1769-L35CR controller.

Figure 4.1

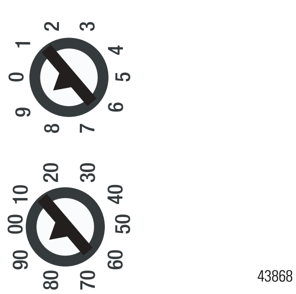


Set the Node Address

Every ControlNet network requires at least one module that is able to store parameters and configure the network with those parameters upon start-up. The CompactLogix 1769-L35CR controller is called a 'keeper' because it keeps the network configuration. The CompactLogix 1769-L35CR controller can keep the network parameters at any legal node address (01 to 99). Multiple devices on any one network can act as the network keepers. Each device capable of being the network keeper acts to back up the current keeper. This backup function is automatic and requires no action on your part.

Node address switches are set to the 99 position at shipment.

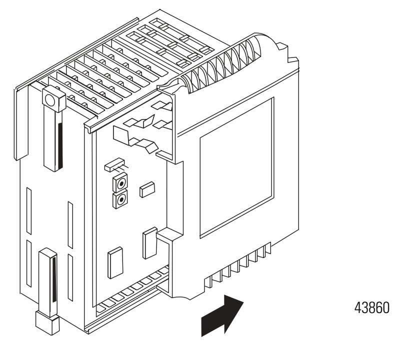
Figure 4.2



1. Make sure power is off at the controller.

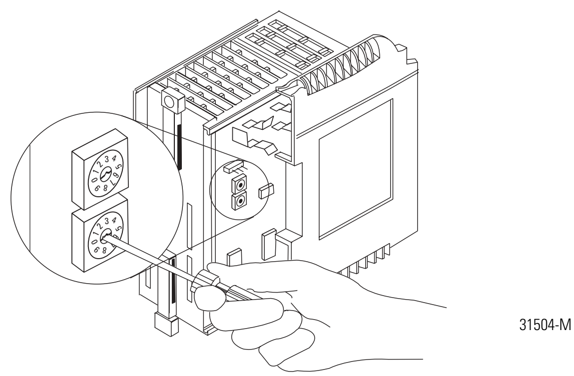
2. Slide the side cover forward as shown in Figure 4.3.

Figure 4.3



3. Set the node addresses via the controller switches, as shown in Figure 4.4.

Figure 4.4

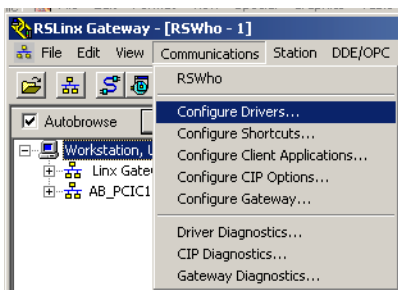


After setting the node address switches, write the node address on the front panel overlay.

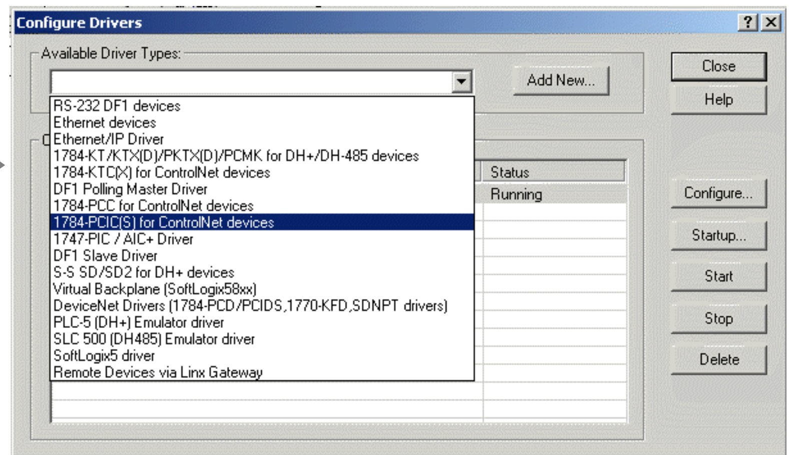
Step 2: Configure the communication driver

Use RSLinx software to configure the ControlNet communication driver. Select the 1784-PCIC(S) devices driver.

1. In RSLinx software, select Configure Driver.



2. Select the appropriate driver.



Controller Connections Over ControlNet

A Logix system uses a connection to establish a communication link between two devices. Connections can be:

- controller to distributed I/O or remote adapter
- produced and consumed tags
- messages

You indirectly determine the number of connections the controller uses by configuring the controller to communicate with other devices in the system. Connections are allocations of resources that provide more reliable communications between devices than unconnected messages.

ControlNet connections can be scheduled or unscheduled. Scheduled connections are managed via RSNetWorx for ControlNet software. An unscheduled connection is a message transfer between controllers that is triggered by the program (such as a MSG instruction). Unscheduled messaging lets you send and receive data when needed.

The 1769-L35CR controller supports 32 connections, 22 of which can be scheduled.

The Network Update Time (NUT) and RPI also play a part in determining how many connections a CompactLogix controller can support in a given application, assuming the RPIs will be the same for all connections. You must also make sure that you do not exceed the maximum number of bytes per NUT.

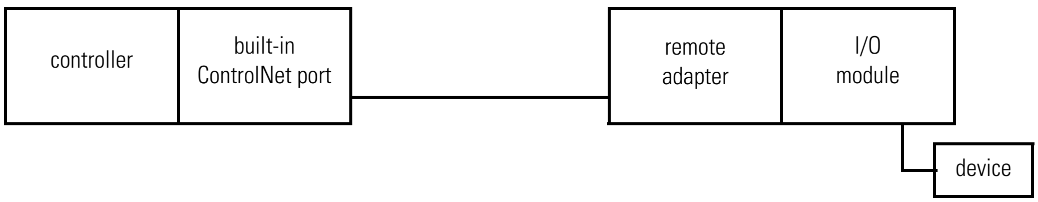
- With the NUT = 5ms, the limit is 3 connections.
- With the NUT = 10ms, the limit is 6 connections.
- With the NUT = 20ms, the limit is 13 connections.
- With the NUT = 40ms, the limit is 22 connections.

Configuring Distributed I/O

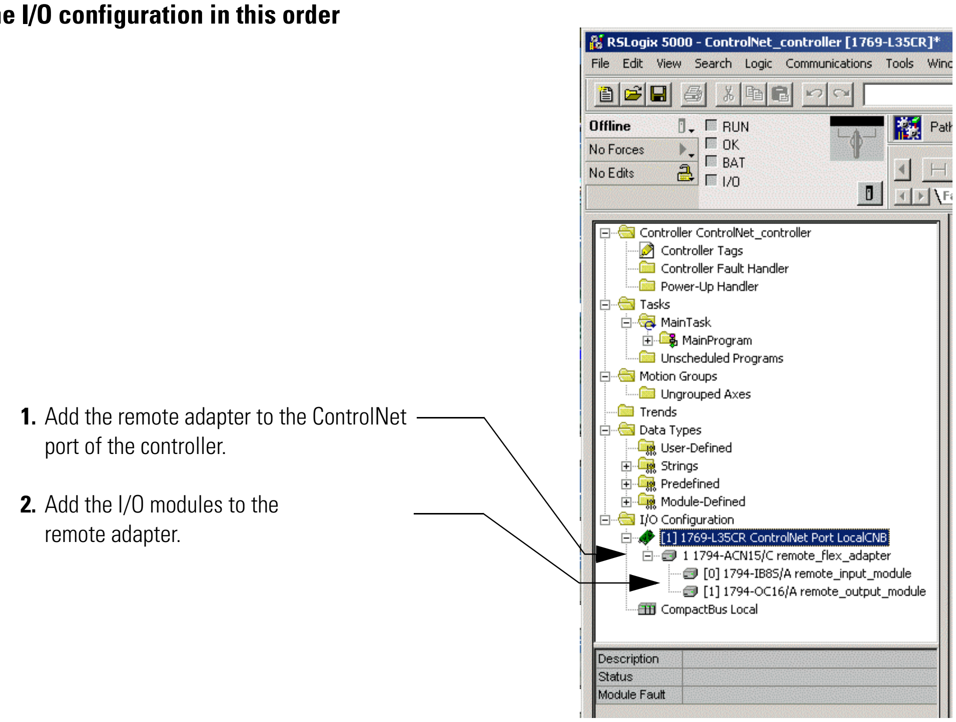
The CompactLogix controller supports distributed I/O over a ControlNet link. Configuring I/O in a remote chassis is similar to configuring local I/O. You create the remote adapter and distributed I/O modules on the local ControlNet port.

To communicate with distributed I/O modules, you add a remote adapter and I/O modules to the I/O Configuration folder of the controller.

For a typical CompactLogix distributed I/O network…



…you build the I/O configuration in this order



Accessing distributed I/O

I/O information is presented as a structure of multiple fields, which depend on the specific features of the I/O module. The name of the structure is based on the location of the I/O module in the system. Each I/O tag is automatically created when you configure the I/O module through the programming software. Each tag name follows this format:

Location:SlotNumber:Type.MemberName.SubMemberName.Bit

where:

Table 4.2

This address variable:	Is:
Location	Identifies network location LOCAL = local DIN rail or chassis ADAPTER_NAME = identifies remote adapter or bridge
SlotNumber	Slot number of I/O module in its chassis
Type	Type of data I = input O = output C = configuration S = status
MemberName	Specific data from the I/O module; depends on the type of data the module can store For example, Data and Fault are possible fields of data for an I/O module. Data is the common name for values the are sent to or received from I/O points.
SubMemberName	Specific data related to a MemberName.
Bit (optional)	Specific point on the I/O module; depends on the size of the I/O module (0-31 for a 32-point module)

EXAMPLE

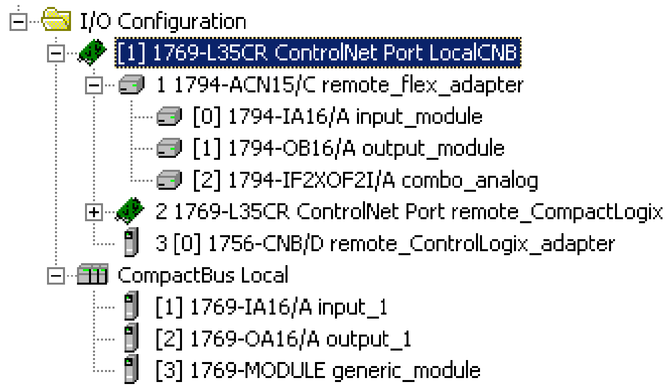


Table 4.3

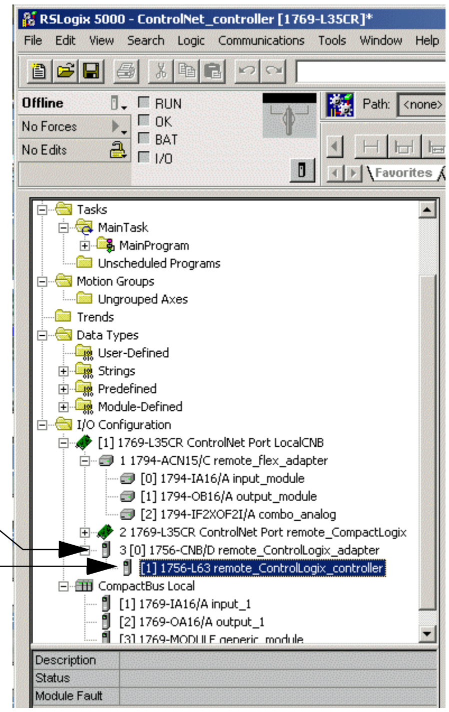
Device:	Example Tag Names (automatically created by the software):
remote adapter “FLEX_io_adapter”	FLEX_io_adapter:I FLEX_io_adapter:I.SlotStatusBits FLEX_io_adapter:I.Data FLEX_io_adapter:O FLEX_io_adapter:O.Data
remote “input_module” in slot 0 rack-optimized connection	FLEX_io_adapter:0:C FLEX_io_adapter:0:C.Config FLEX_io_adapter:0:C.DelayTime_0 FLEX_io_adapter:0:C.DelayTime_1 FLEX_io_adapter:0:C.DelayTime_2 FLEX_io_adapter:0:C.DelayTime_3 FLEX_io_adapter:0:C.DelayTime_4 FLEX_io_adapter:0:C.DelayTime_5 FLEX_io_adapter:0:I
remote “output_module” in slot 1 rack-optimized connection	FLEX_io_adapter:1:C FLEX_io_adapter:1:C.SSData FLEX_io_adapter:1:O FLEX_io_adapter:1:O.Data
remote “combo_analog” in slot 2 direct connection	FLEX_io_adapter:2:C FLEX_io_adapter:2:C.InputFIlter FLEX_io_adapter:2:C.InputConfiguration FLEX_io_adapter:2:C.OutputConfiguration FLEX_io_adapter:2:C.RTSInterval FLEX_io_adapter:2:C.SSCh0OuputData FLEX_io_adapter:2:C.SSCH1OutputData Compact_adapter:2:I

Adding a Remote Controller

If you want to add the controller as a remote consumed controller to the I/O configuration, follow the example below..

To add a remote controller, you build the I/O configuration in this order

1. Add a remote ControlNet adapter to the local CompactLogix controller.
2. Add the remote controller.



Producing and Consuming Data

The1769-L35CR controller supports the ability to produce (broadcast) and consume (receive) system-shared tags over a ControlNet link. Produced and consumed data is accessible by multiple controllers over a ControlNet network. Produced and consumed data are scheduled connections because the controller sends or receives data at a predetermined RPI rate.

IMPORTANT The 1769-L35CR can produce and consume tags over ControlNet to other Logix5000 controllers. However, Compact I/O that is local to the 1769-L35CR controller is not accessible to other Logix5000 controllers.

Produced and consumed tags must be of DINT or REAL data type or a structure. You can use a user-defined structure to group BOOL, SINT, and INT data to be produced.

Table 4.4

Tag type:	Description:	Specify:
produced	These are tags that the controller produced for other controllers to consume.	• Enabled for producing • How many consumers allowed
consumed	These are tags whose values are produced by another controller.	• Controller name that owns the tag that the local controller wants to consume • Tag name or instance that the controller wants to consume • Data type of the tag to consume • Update interval of how often the local controller consumes the tag

The producer and consumer must be configured correctly for the specified data to be shared. A produced tag in the producer must be specified exactly the same as a consumed tag in the consumer.

If any produced/consumed tag between a producer and consumer is not specified correctly, none of the produced/consumed tags for that producer and consumer will be transferred. However, other consumers can still access their shared tags, as long as their tags are specified correctly. One consumer failing to access shared data does not affect other consumers accessing the same data.

Maximum number of produced and consumed tags

The maximum number of produced/consumed tags that you can configure depends on the connection limits of the communication device that transfers the produced/consumed data.

Each produced tag uses one connection for the tag and the first configured consumer of the tag. Each consumer thereafter uses an additional connection.

Size limit of a produced or consumed tag

A produced or consumed tag can be as large as 488 bytes, but it must also fit within the bandwidth of the ControlNet network:

- As the number of connections over a ControlNet network increases, several connections, including produced or consumed tags, may need to share a network update.
- Since a ControlNet network can only pass 500 bytes in one update, with 12 bytes of the 500 needed for network overhead, the data of each connection must be equal to or less than 488 bytes to fit into the update.

If a produced or consumed tag is too large for your ControlNet network, the network verification will fail in RSLogix 5000. In this case, make one or more of the following adjustments:

- Separate the tag into two or more smaller tags:
  - Group the data according to similar update rates. For example, you could create one tag for data that is critical and another tag for data that is not as critical.
  - Assign a different RPI to each tag.
- Create logic to transfer the data in smaller sections (packets).

Producing a tag

Produced data must be of DINT or REAL data type or an array or structure. You can use a user-defined structure to group BOOL, SINT, and INT data to be produced. To create a produced tag:

1. You must be programming offline.
2. In the controller organizer, double-click the Controller Tags folder and then click the Edit Tags tab.
3. Select the tag that you want to produce, or enter a new tag, and display the Tag Properties dialog box.
4. Make sure the tag is controller scope.
5. Select the "Produce this tag" check box. Specify how many controllers can consume the tag.

You can produce a base, alias, or consumed tag.

The consumed tag in a receiving controller must have the same data type as the produced tag in the originating controller. The controller performs type checking to ensure proper data is being received.

Produced tags require connections. The number of connections depends on how many controllers are consuming the tags. The controller requires one connection for the produced tag and the first consumer. Then, the controller requires an additional connection for each subsequent consumer.

Consuming a tag

A consumed tag represents data that is produced (broadcast) by one controller and received and stored by the consuming controller. To create a consumed tag:

1. You must be programming offline.
2. In the controller organizer, double-click the Controller Tags folder and then click the Edit Tags tab.
3. Select the tag that you want to consume, or enter a new tag, and display the Tag Properties dialog box.
4. Specify the information described in Table 4.5:

Table 4.5

In this field:	Type or select:
Tag Type	Select Consumed.
Controller	Select the name of the other controller. You must have already created the controller in the controller organizer for the controller name to be available.
Remote Tag Name Remote Instance	Type a name for the tag in the other controller you want to consume. **Important:** The name must match the name in the remote controller exactly, or the connection faults. If the remote controller is a ControlNet PLC-5, this field is Remote Instance. Select the instance number (1-128) of the data on the remote controller.
RPI (requested packet interval)	Type the amount of time in msec between updates of the data from the remote controller. The local controller will receive data at least this fast.
Display Style	If you are creating a consumed tag that refers to a tag whose data type is BOOL, SINT, INT, DINT, or REAL, you can select a display style. This display style defines how the tag value will be displayed in the data monitor and ladder editor. The display style does not have to match the display style of the tag in the remote controller.

All consumed tags are automatically controller-scope. To consume data from a remote controller, use RSNetWorx software to schedule the connection over the ControlNet network.

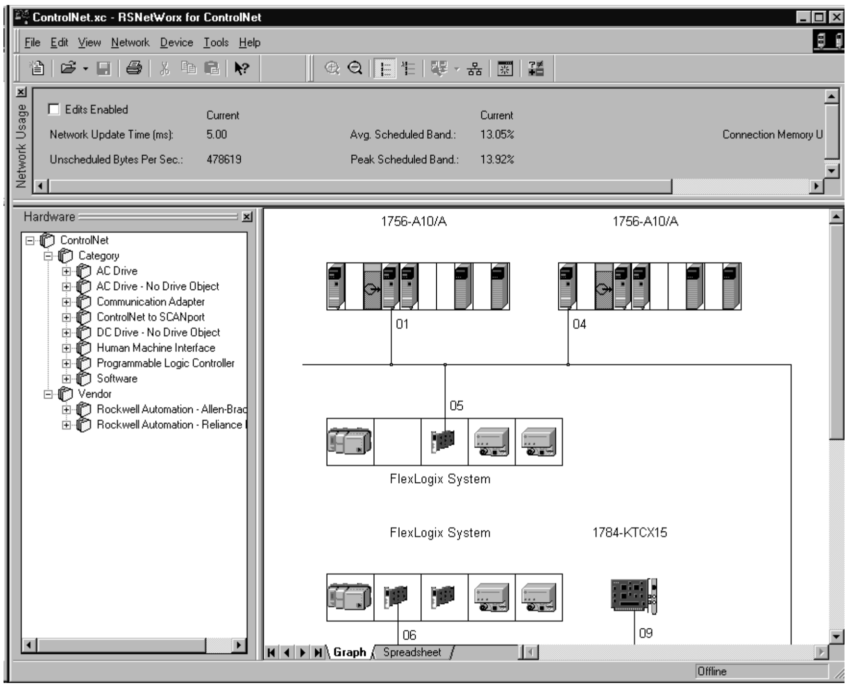
The produced tag in the originating CompactLogix controller must have the same data type as the consumed tag in the other Logix-based controller. The CompactLogix controller performs type checking to ensure proper data is being received.

IMPORTANT If a consumed-tag connection fails, none of the tags are transferred from the producing controller to the consuming controller.

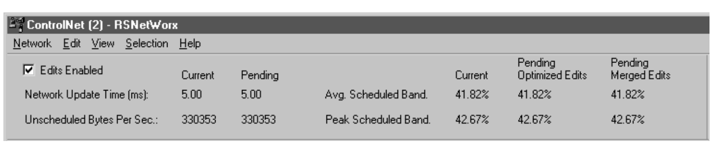
Scheduling the ControlNet Network

Use RSNetWorx software to schedule the ControlNet network. The controller project must already be downloaded from RSLogix 5000 programming software to the controller and the controller must be in Program or Remote Program mode.

1. In RSNetWorx software, go online, enable edits, and browse the network.

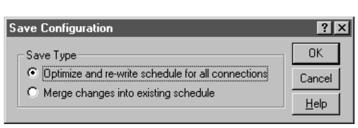


2. Specify the network update time (NUT)



The default NUT is 5ms. The NUT you specify must be lower than or equal to the lowest RPI in your ControlNet network. The RPI numbers for the local and extended-local DIN rails do not affect the network NUT.

3. After you specify the NUT, save and re-write the schedule for all connections.



Every device on the network must be in Program or Remote Program mode for the software to re-write all its connections. If a device is not in the correct mode, the software prompts you to let it change the device's mode.

If RSNetWorx for ControlNet cannot schedule the network, make one or more of the following adjustments:

- Reduce the Network Update Time (NUT). At a faster NUT, less connections have to share an update slot.
- Increase the Requested Packet Interval (RPI) of all connections. At a higher RPI, connections can take turns sending data during an update slot.
- For a ControlNet bridge module in a remote chassis, select the most efficient communication format for that chassis:.

Table 4.6

Are most of the modules in the chassis non-diagnostic, digital I/O modules?	Then select this communication format for the remote communication module:
yes	rack optimization
no	none

The Rack Optimization format uses an additional 8 bytes for each slot in its chassis. Analog modules or modules that are sending or getting diagnostic, fuse, or timestamp data require direct connections and cannot take advantage of the rack optimized form. Selecting “None” frees up the 8 bytes per slot for other uses, such as produced or consumed tags.

Sending Messages

The 1769-L35CR controller can send MSG instructions to other controllers over a ControlNet link. Each MSG instruction requires you to specify a target and an address within the target. The number of messages that a device can support depends on the type of message and the type of device:

MSG instructions are unscheduled. The type of MSG determines whether or not it requires a connection. If the MSG instruction requires a connection, it opens the needed connection when it is executed. You can configure the MSG instruction to keep the connection open (cache) or to close it after sending the message.

Table 4.7

This type of message:	And this communication method:	Uses a connection:
CIP data table read or write		Yes
PLC2, PLC3, PLC5, or SLC (all types)	CIP	No
	CIP with Source ID	No
	DH+	Yes
CIP generic	CIP	Optional[1]
block-transfer read or write		Yes

(1) You can connect CIP generic messages, but for most applications, we recommend you leave CIP generic messages unconnected.

Connected messages are unscheduled connections on ControlNet.

If a MSG instruction uses a connection, you have the option to leave the connection open (cache) or close the connection when the message is done transmitting.

If you:	Then:
Cache the connection	The connection stays open after the MSG instruction is done. This optimizes execution time. Opening a connection each time the message executes increases execution time.
Do not cache the connection	The connection closes after the MSG instruction is done. This frees up that connection for other uses.

IMPORTANT

The update time of local I/O modules may increase when the controller is bridging messages.

Bridging over the CompactLogix controller should be targeted toward applications that are not real time dependent, such as RSLogix 5000 program downloads and ControlFlash updates.

Communicating with another Logix-based controller

All Logix-based controllers can use MSG instructions to communicate with each other. The following examples show how to use tags in MSG instructions between Logix-based controllers.

Table 4.8

Type of MSG Instruction:	Example Source and Destination:	
Logix-based controller writes to Logix-based controller (CIP Data Table Write)	source tag destination tag	array_1 array_2
Logix-based controller reads from Logix-based controller (CIP Data Table Read)	source tag destination tag	array_1 array_2

The source and destination tags:

- must be controller-scoped tags.
- can be of any data type, except for AXIS, MESSAGE, or MOTION_GROUP.

Communicating with other controllers over ControlNet

The CompactLogix controller also uses MSG instructions to communicate with PLC and SLC controllers. The MSG instructions differ depending on which controller initiates the instruction.

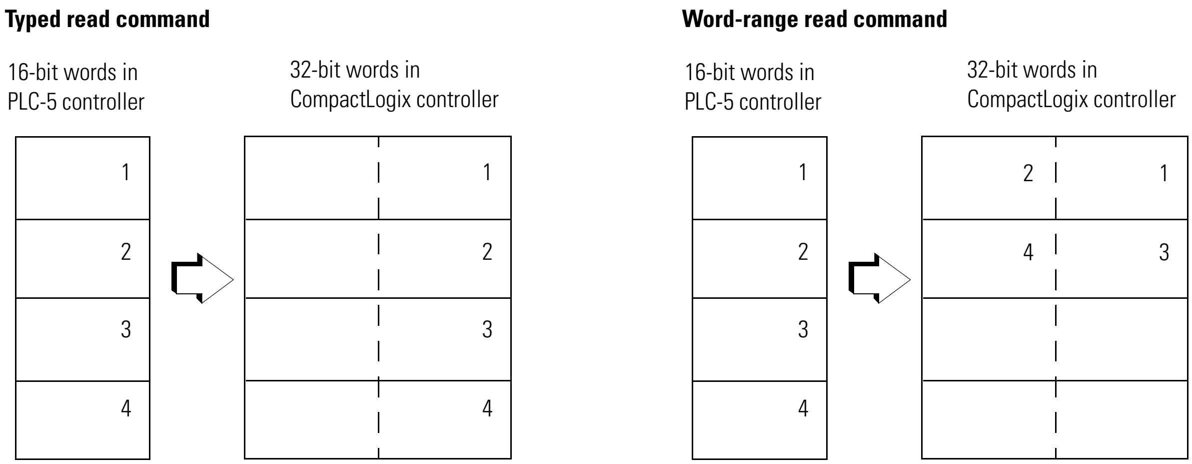
For MSG instructions originating from a CompactLogix controller to a PLC or SLC controller:

Table 4.9

Type of MSG Instruction:	Supported Source File Types:	Supported Destination File Types:
Write to PLC-5 or SLC	In the CompactLogix controller, specify the source data type based on the destination device: PLC-5: SINT, INT, DINT, or REAL SLC: INT or REAL Example source element: *array_1*	Specify the destination file type based on the destination device: PLC-5 typed write: S, B, N, or F PLC-5 word-range write: S, B, N, F, I, O, A, or D SLC: B, N or F Example destination tag: *N7:10*
Write to PLC-2	In the CompactLogix controller, select one of these data types: SINT, INT, DINT, or REAL Example source element: *array_1*	Use the PLC-2 compatibility file. Example destination tag: *010*
Read from PLC-5 or SLC	Specify the destination file type based on the destination device: PLC-5 typed read: S, B, N, or F PLC-5 word-range read: S, B, N, F, I, O, A, or D SLC: B, N or F Example source element: *N7:10*	In the CompactLogix controller, specify the destination data type based on the destination device: PLC-5: SINT, INT, DINT, or REAL SLC: INT or REAL Example destination tag: *array_1*
Read from PLC-2	Use the PLC-2 compatibility file. Example source element: *010*	In the CompactLogix controller, select one of these data types: SINT, INT, DINT, or REAL Example destination tag: *array_1*

The CompactLogix controller can send typed or word-range commands to PLC-5 controllers. These commands read and write data differently. The diagrams in Figure 4.5 show how the typed and word-range commands differ.

Figure 4.5



The typed commands maintain data structure and value.

The word-range commands fill the destination tag contiguously. Data structure and value change depending on the destination data type.

The CompactLogix controller can process messages initiated from PLC or SLC controllers. These messages use data table addresses. In order for these controllers to access tags within the CompactLogix controller, you map tags to data table addresses.

Mapping addresses

The programming software includes a PLC/SLC mapping tool which allows you to make an existing controller array tag in the local controller available to PLC-2, PLC-3, PLC-5, or SLC controllers.

To map addresses:

1. From the Logic menu, select Map PLC/SLC Messages.

2. Specify the information described in Table 4.10:

Table 4.10

For:	In this field:	Specify:	For example:
PLC-3, PLC-5, and SLC controllers	File Number	Type the file number of the data table in the PLC/SLC controller.	10
	Tag Name	Type the array tag name the local controller uses to refer to the PLC/SLC data table address. The tag must be an integer array (SINT, INT, or DINT) that is large enough for the message data.	array_1
PLC-2 controllers	Tag Name	Type the tag name to be the PLC-2 compatibility file.	200

TIP You can map as many tags as you want to a PLC-3, PLC-5, or SLC controller. You can map only one tag to a PLC-2 controller.

Table 4.11 shows example source and destination tags and elements for different controller combinations.

Table 4.11

Type of MSG Instruction:	Example Source and Destination:	
PLC-5 writes to CompactLogix SLC writes to CompactLogix SLC 5/05 SLC 5/04 OS402 and above SLC 5/03 OS303 and above	source element	N7:10
	destination tag	"array_1"
	The PLC-5, PLC-3, and SLC controllers support logical ASCII addressing so you do not have to map a compatibility file for MSG instructions initiated by a PLC-5, PLC-3, or SLC controller. Place the CompactLogix tag name in double quotes ("). You could optionally map a compatibility file. For example, if you enter *10* for the compatibility file, you enter *N10:0* for the destination tag.	
PLC-2 writes to CompactLogix	source element	010
	destination tag	200
	The destination tag is the three-digit PLC-2 address you specified for PLC-2 mapping.	
PLC-5 reads from CompactLogix SLC reads from CompactLogix SLC 5/05 SLC 5/04 OS402 and above SLC 5/03 OS303 and above	source tag	"array_1"
	destination element	N7:10
	The PLC-5, PLC-3, and SLC controllers support logical ASCII addressing so you do not have to map a compatibility file for MSG instructions initiated by a PLC-5, PLC-3, or SLC controller. Place the CompactLogix tag name in double quotes ("). You could optionally map a compatibility file. For example, if you enter *10* for the compatibility file, you enter *N10:0* for the source tag.	
PLC-2 reads from CompactLogix	source tag	200
	destination element	010
	The source tag is the three-digit PLC-2 address you specified for PLC-2 mapping.	

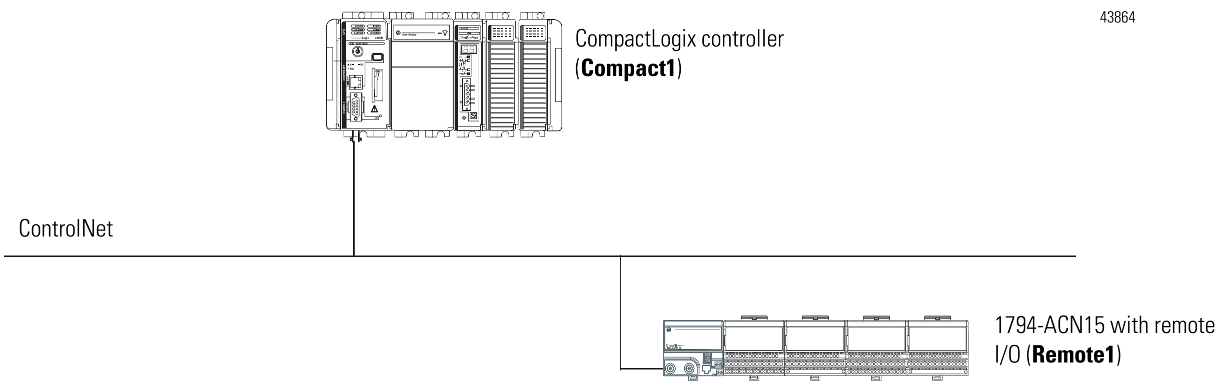
When the CompactLogix controller initiates messages to PLC or SLC controllers, you do not have to map compatibility files. You enter the data table address of the target device just as you would a tag name.

SLC 5/05 controllers, SLC 5/04 controllers (OS402 and above), and SLC 5/03 controllers (OS303 and above) support logical ASCII addressing and support PLC/SLC mapping (see the examples above). For all other SLC or MicroLogix1000 controllers, you must map a PLC-2 compatibility file (see the PLC-2 examples above).

Example 1: CompactLogix Controller and Distributed I/O

In the Figure 4.6 example, one CompactLogix controller controls remote I/O through a 1794-ACN15 module.

Figure 4.6



Controlling distributed I/O

This example has Compact1 controlling the I/O connected to the remote 1794-ACN15 module. The data the CompactLogix controller receives from the distributed I/O modules depends on how you configure the remote I/O modules. You can configure each module as a direct connection or as rack optimized. One chassis can have a combination of some modules configured as a direct connection and others as rack optimized.

Total connections required by Compact1

The following table calculates the connections used in this example.

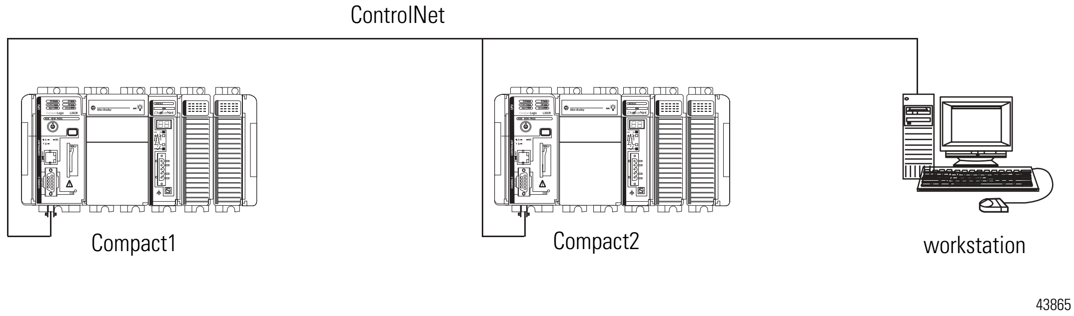
Connection:	Amount:
Compact1 controller to remote 1794-ACN15	1
Compact1 to 4 distributed I/O modules (through 1794-ACN15) • all I/O modules configured as direct connection	4
total connections used:	5

If you configured the distributed I/O modules as rack-optimized, you would only need a rack-optimized connection to the 1794-ACN15, reducing the above example by 4 connections.

Example 2: CompactLogix Controller to CompactLogix Controller

In the Figure 4.7 example, one CompactLogix controller communicates with another CompactLogix controller over ControlNet. Each controller has its own local I/O.

Figure 4.7

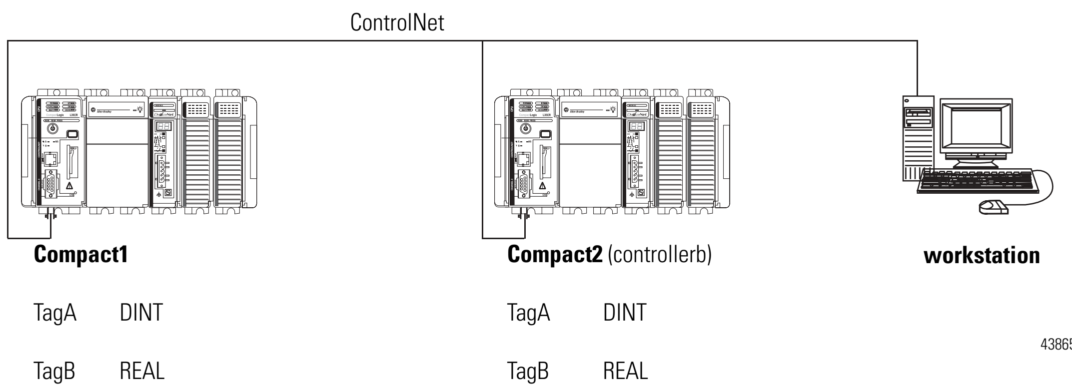


Producing and consuming tags

Produced data must be of DINT or REAL data type or an array or structure. You can use a user-defined structure to group BOOL, SINT, and INT data to be produced. You can produce a base, alias, or consumed tag.

The consumed tag must have the same data type as the produced tag in the originating controller. The controller performs type checking to ensure proper data is being received.

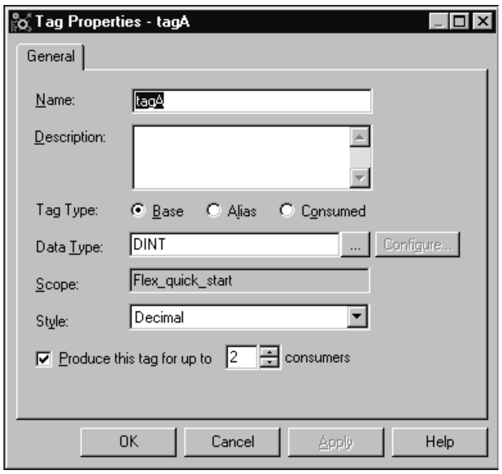
Figure 4.8



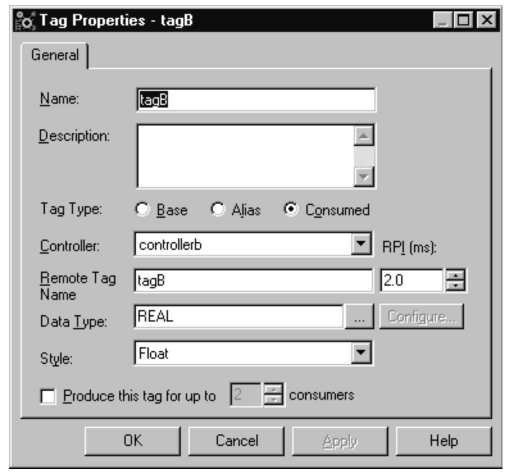
This example shows Compact1 as producing TagA and consuming TagB:

☑	⊞-tagA			DINT	Decimal
☐	tagB		controllerb:tagB	REAL	Float
☐					

TagA



TagB



Each produced tags requires one connection for the producing controller and an additional connection for each consuming controller. Each consumed tag requires one connection.

Sending a MSG instruction

To send a MSG from Compact1 to Compact2:

1. For Compact1, create a controller-scoped tag and select the MESSAGE data type.
2. Enter a MSG instruction.

   In this example logic, a message is sent when a specific condition is met. When count_send is set, send count_msg.

3. Configure the MSG instruction. On the Configuration tab:

For this item:	Specify:
Message Type	CIP Data Table Read or CIP Data Table Write
Source Tag	Tag containing the data to be transferred
Number of Elements	Number of array elements to transfer
Destination Tag	Tag to which the data will be transferred

4. On the Communication tab, specify the communication path.

   A communication path requires pairs of numbers. The first number in the pair identifies the port from which the message exits. The second number in the pair designates the node address of the next device.

For this item:	Specify:
Communication Path	1,1,2,xx,1,0 where: 1 is the virtual backplane of Compact1 1 is the slot of the ControlNet port in the controller 2 is the ControlNet port xx is the ControlNet node of Compact2 1 is the virtual backplane of Compact2 0 is the controller slot of Compact2

Total connections required by Compact1

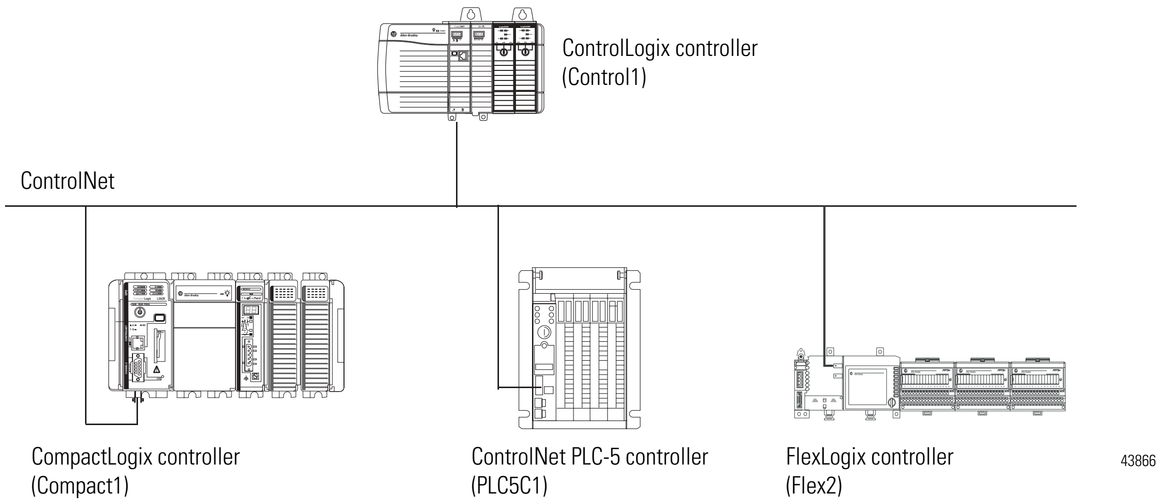
The following table calculates the connections used in this example.

Connection:	Amount:
connected, cached MSG from Compact1 to Compact2	1
produced TagA	
• produced from Compact1 to Compact2	1
• other consumer (2 are configured)	1
consumed TagB	1
total connections used:	4

Example 3: CompactLogix Controller to Other Devices

In the Figure 4.9 example, one CompactLogix controller communicates with a ControlLogix controller and a ControlNet PLC-5 controller over ControlNet

Figure 4.9



Sending a MSG instruction to another Logix-based controller

You configure a MSG instruction to other Logix-based controllers the same as you do for a CompactLogix controller. All Logix-based controllers follow the same MSG configuration requirements.

1. In the CompactLogix controller, create a controller-scoped tag and select the MESSAGE data type. Enter a MSG instruction. See Example 2 above for an example.

2. Configure the MSG instruction. On the Configuration tab:

For this item:	Specify:
Message Type	CIP Data Table Read or CIP Data Table Write
Source Tag	Tag containing the data to be transferred
Number of Elements	Number of array elements to transfer
Destination Tag	Tag to which the data will be transferred

3. On the Communication tab, specify the communication path.

Use the Browse button to select the device that will receive the MSG instruction. The communication path in this example is:

For this item:	Specify:
Communication Path	1,1,2,xx,1,0 where: 1 is the virtual backplane of Compact 1 1 is the slot of the ControlNet port in the controller 2 is the ControlNet network xx is the node address of the Logix controller 1 is the backplane of Logix controller 0 is the controller slot of Logix controller

Sending a MSG instruction to a PLC-5C processor

Configuring a MSG instruction for a PLC-5 processor requires different MSG configuration and PLC/SLC mapping.

1. In the CompactLogix controller, create a controller-scoped tag and select the MESSAGE data type. Enter a MSG instruction. See Example 2 above for an example.

2. Configure the MSG instruction. On the Configuration tab:

For this item:	Specify:
Message Type	PLC-5 Typed Read or PLC-5 Typed Write or PLC-5 Word Range Read or PLC-5 Word Range Write
Source Tag	Tag containing the data to be transferred
Number of Elements	Number of array elements to transfer
Destination Tag	Tag to which the data will be transferred

The source and destination data types depend on the message type you select:

Type of Logix MSG instruction:	Source:	Destination:
PLC-5 Typed Read	any integer element (such as B3:0, T4:0.ACC, C5:0.ACC, N7:0, etc.)	SINT, INT, or DINT tag
	any floating point element (such as F8:0, PD10:0.SP, etc.)	REAL tag
PLC-5 Typed Write	SINT or INT tag	any integer element (such as B3:0, T4:0.ACC, C5:0.ACC, N7:0, etc.)
	REAL tag	any floating point element (such as F8:0, PD10:0.SP, etc.)
PLC-5 Word Range Read	any data type (such as B3:0, T4:0, C5:0, R6:0, N7:0, F8:0, etc.)	SINT, INT, DINT, or REAL
PLC-5 Word Range Write	SINT, INT, DINT, or REAL	any data type (such as B3:0, T4:0, C5:0, R6:0, N7:0, F8:0, etc.)

3. On the Communication tab, specify the communication path.

   Use the Browse button to select the device that will receive the MSG instruction. The communication path in this example is:

For this item:	Specify:
Communication Path	1,1,2,xx where: 1 is the virtual backplane of Compact 1 1 is the slot of the ControlNet port in the controller 2 is the ControlNet network xx is the node address of PLC5C1

Sending a MSG instruction from a PLC-5C processor to a CompactLogix controller

The PLC-5C processor supports logical ASCII addressing so you do not have to map a compatibility file for MSG instructions initiated by a PLC-5 processor. Place the CompactLogix tag name in double quotes (“).

Type of MSG Instruction:	Example Source and Destination:	
PLC-5 writes to CompactLogix	source element	*N7:10*
	destination tag	*“array_1”*
PLC-5 reads from CompactLogix	source tag	*“array_1”*
	destination element	*N7:10*

Producing and consuming tags to a Logix-based controller

You can produce and consume tags with any Logix controller the same as you do with a CompactLogix controller. All Logix controllers follow the same requirements for producing and consuming tags.

Producing a tag to a ControlNet PLC-5 controller

To produce a tag that a ControlNet PLC-5 controller can consume:

1. Determine the type of data to produce.

If:	And you are producing:	Then:
INT	na	A. Create a user-defined data type that contains an array of INTs with an even number of elements, such as INT[2]. When you produce INTs, you must produce two or more. B. Create a produced tag and select the user-defined data type you created.
DINT or REAL	Only one DINT or REAL value	Create a produced tag and select the DINT or REAL data type, as appropriate.
	More than one DINT or REAL	A. Create a user-defined data type that contains an array of DINTs or REALs, as appropriate. B. Create a produced tag and select the user-defined data type you created.

2. In RSNetWorx software, open the ControlNet configuration for the target ControlNet PLC-5 controller, insert a Receive Scheduled Message and enter the following Message size:

If the produced tag contains:	Then, for the Message size, enter:
INTs	The number of integers in the produced tag
DINTs	Two times the number of DINTs or REALs in the produced tag. For example, if the produced tag contains 10 DINTs, enter 20 for the Message size.
REALs	

3. In the RSNetWorx software, reschedule (save) the network.

The ControlNet PLC-5 controller does not perform type checking. Make sure the PLC-5 data type can correctly receive the CompactLogix produced tag to ensure proper data is being received.

When a ControlNet PLC-5 controller consumes a tag that is produced by a Logix5000 controller, it stores the data in consecutive 16-bit integers. The ControlNet PLC-5 controller stores floating-point data, which requires 32-bits regardless of the type of controller, as follows:

- The first integer contains the upper (left-most) bits of the value.
- The second integer contains the lower (right-most) bits of the value.

To re-construct the floating point data within the ControlNet PLC-5 controller, first reverse the order of the integers and then copy them to a floating-point file.

Consuming a tag from a ControlNet PLC-5 controller

To consume a tag from a ControlNet PLC-5 controller:

1. In RSNetWorx software, open the ControlNet configuration of the ControlNet PLC-5 controller, insert a Send Scheduled Message.

2. In RSLogix 5000 software, add the ControlNet PLC-5 controller to the Controller Organizer.

3. Create a user-defined data type that contains these members:

Data type:	Description:
DINT	Status
INT[x], where "x" is the output size of the data from the ControlNet PLC-5 controller. (If you are consuming only one INT, no dimension is required.)	Data produced by a ControlNet PLC-5 controller

4. Create a consumed tag with the following properties:

For this tag property:	Type or select:
Tag Type	Consumed
Controller	The ControlNet PLC-5 that is producing the data
Remote Instance	The message number from the ControlNet configuration of the ControlNet PLC-5 controller
RPI	A power of two times the NUT of the ControlNet network. For example, if the NUT is 5ms, select an RPI of 5, 10, 20, 40, etc.
Data Type	The user-defined data type that you created.

5. In the RSNetWorx for ControlNet software, reschedule (save) the network.

Total connections required by Compact1

The following table calculates the connections used in this example.

Connection:	Amount:
Compact1 controller to remote 1756-CNB	1
Compact1 controller to remote ControlNet PLC-5	1
connected, cached MSG from Compact1 to Control1	1
connected, cached MSG from Compact1 to PLC5C1	1
Produced TagA • produced from Compact to Flex2 • consumed by PLC5C1	 1 1
Consumed TagB from Flex2	1
Consumed INT from PLC5C1	1
total connections used:	8

You can configure the 1756-CNB module to use no connection. This is useful if you configure all direct connections to their associated I/O modules and do not need a rack-optimized connection.

Communicating with Devices on a DeviceNet link

Using This Chapter

CompactLogix controllers can connect to the DeviceNet network via the 1769-SDN scanner module.

Table 5.1

Configuring Your System for a DeviceNet Link

Select the appropriate DeviceNet interface depending on the application and how the controller interacts with the devices:

Table 5.2

If your application:	Select this interface:	Description:
• communicates with other DeviceNet devices • uses the controller as a master or slave on DeviceNet • uses the controller Ethernet port or serial port for other communications	1769-SDN DeviceNet scanner module	The scanner acts as an interface between DeviceNet devices and the CompactLogix controller. The scanner lets the controller: • read inputs from slave devices • write outputs to slave devices
• accesses remote Compact I/O over a DeviceNet network • sends remote I/O data for as many as 30 modules back to scanner or controller	1769-ADN DeviceNet adapter module[1]	The adapter: • interfaces with as many as 30 Compact I/O modules • communicates to other network system components (typically a controller or scanner and/or programming terminals) over the DeviceNet network

[1] This table specifically describes using the 1769-ADN to access remote Compact I/O over DeviceNet. However, CompactLogix controllers can access other Allen-Bradley remote I/O over DeviceNet. In those cases, you must select the appropriate interface. For example, if accessing remote POINT I/O modules, you must select the 1734-ADN.

You can also bridge from EtherNet/IP to DeviceNet through a CompactLogix controller with a 1769-SDN. This bridging lets you:

- configure the 1769-SDN scanner and its DeviceNet devices using RSNetWorx connected via an EtherNet/IP connection.
- flash 1769-SDN firmware via an EtherNet/IP connection.

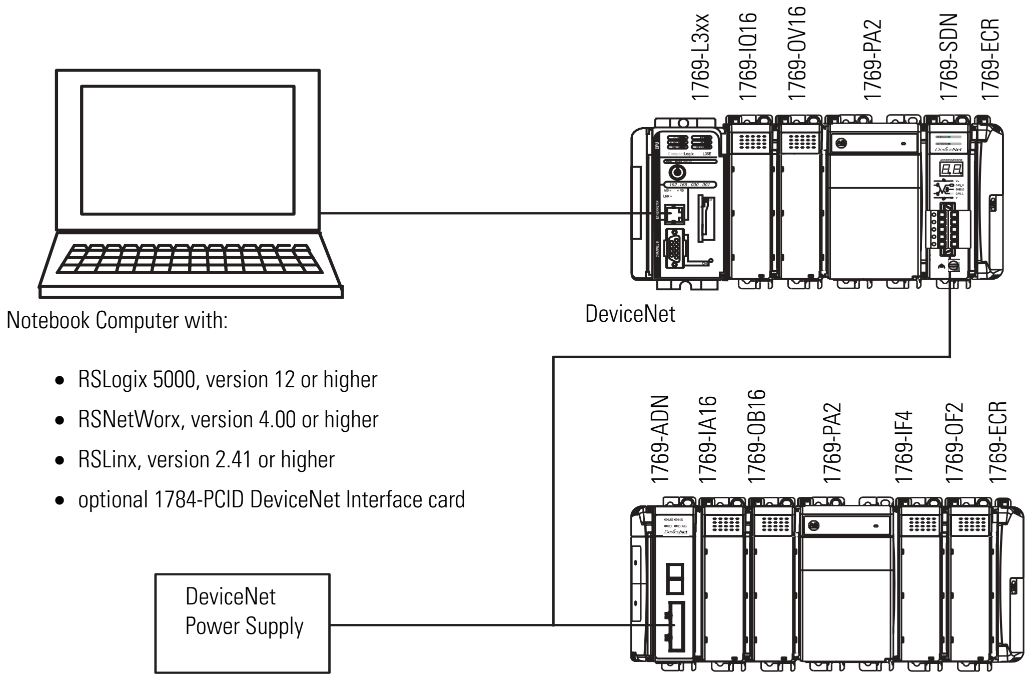
To bridge from EtherNet/IP to DeviceNet, you need:

- 1769-SDN with firmware revision 2.2 or greater
- most current EDS files for both the controller and the 1769-SDN

Example 1: Controlling DeviceNet Devices

This example in Figure 5.1 uses a 1769-SDN scanner module in the local CompactLogix system to control the I/O attached to a 1769-ADN adapter module.

Figure 5.1



This example describes:

- using RSNetWorx for DeviceNet to assign node addresses to the 1769-SDN and the 1769-ADN and map the adapter's image into the scanner
- creating a CompactLogix project including the necessary configuration for the 1769-SDN DeviceNet scanner module
- controlling outputs and reading inputs with the distributed I/O via DeviceNet

The computer does not have to be connected to the DeviceNet network. The connection path in this example is through the controller. If you have a 1769-SDN module with firmware revision 2.2 or greater, you can bridge to the 1769-SDN module through one of the following ports:

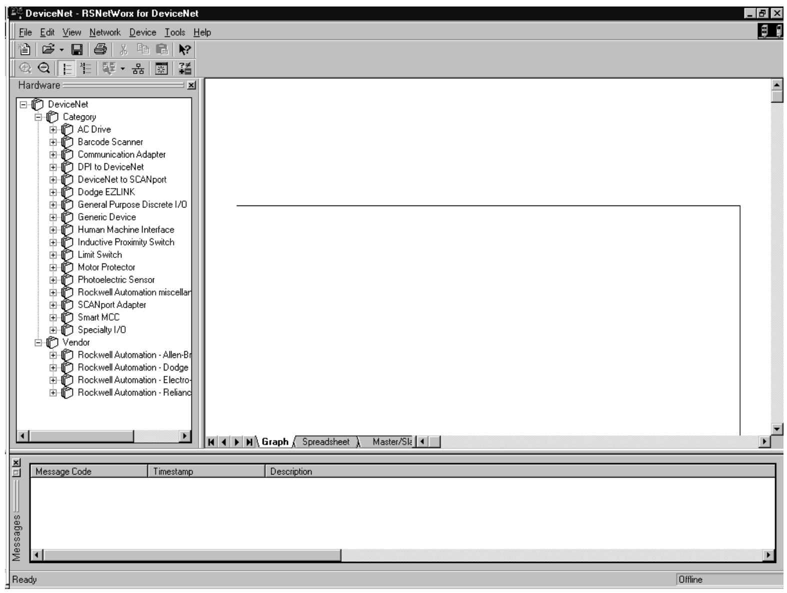
- ControlNet port – available on the 1769-L35CR only
- EtherNet/IP port – available on the 1769-L32E and 1769-L35E only
- serial port – available on the 1769-L32E, 1769-L35CR and 1769-L35E controllers

Step 1: Configuring the 1769-ADN adapter

1. Start RSNetWorx.

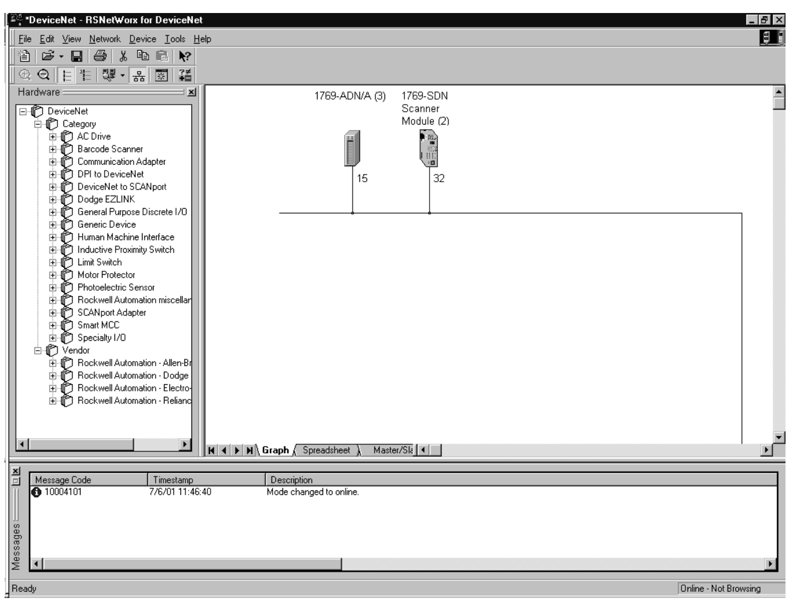
2. Select Network →Online. The RSLinx communication driver screen appears.

3. Choose the appropriate driver depending on whether the computer is directly connected to DeviceNet or you are bridging through the controller's EtherNet/IP or ControlNet port.



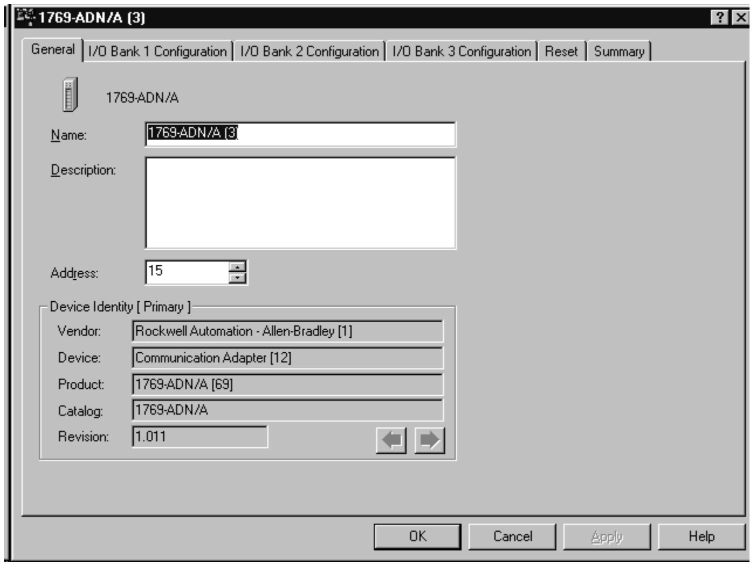
4. The software then prompts you to either upload or download. Choose upload. RSNetWorx browses the network for valid devices. The online screen should look something like the following, where the 1769-ADN is node 15, and the 1769-SDN is node 32 for this example.

   If you had connected via DeviceNet, such as through a 1784-PCID card, the communication card would also appear as a node on the DeviceNet network.



continued

5. Right click on the 1769-ADN and choose Properties.



5. Click on the I/O Bank 1 Configuration tab, then choose upload when prompted. The actual 1769-ADN I/O layout appears. From this screen you can configure the I/O modules in the 1769-ADN system by simply clicking on the slot number box associated with each I/O module.

6. When the I/O modules are configured, click on the Summary tab. Note the number of bytes of input and output data. This will be used later when adding the adapter to the 1769-SDN's scanlist.

7. Click Apply, then OK to save the configuration and download it to the adapter.

For this example, you only configure the two analog modules. For more information about analog modules, see the *Compact I/O Analog Modules User Manual*, publication 1769-UM002. Only analog and specialty modules are configurable. Discrete I/O modules, power supplies, and end caps are not configurable.

TIP

Configuration changes made to the adapter or any of its I/O modules with RSNetWorx will not be saved or downloaded to the adapter once the adapter is configured in a scanner's scanlist.

To make configuration changes, the controller must be placed into the Program mode and the adapter must be temporarily removed from the scanner's scanlist.

Step 2: Setting up the 1769-SDN scanlist

The 1769-SDN series B scanner supports automatic device recovery (ADR). An ADR tab appears in the scanlist window in RSNetWorx for DeviceNet for series B scanners so you can enable the ADR feature. This feature:

- automates the replacement of a failed slave device on a DeviceNet network by returning the device to the prior level of operation
- includes automatic address recovery which allows a slave device to be removed from the network and replaced with another identical slave device that is residing on the network at node 63 and is not in the scanlist.
- includes configuration recovery which allows a slave device to be removed from the network and replaced with an identical device with the same configuration

IMPORTANT	To maintain proper mapping between the controller tags and the 1769-SDN scanlist, make sure you are using version 4.12 or greater of RSNetWorx for DeviceNet software and the most current 1769-SDN EDS files. This updated software lets you select the CompactLogix controller as a mapping configuration, which ensures that the scanlist and controller tags properly coincide.

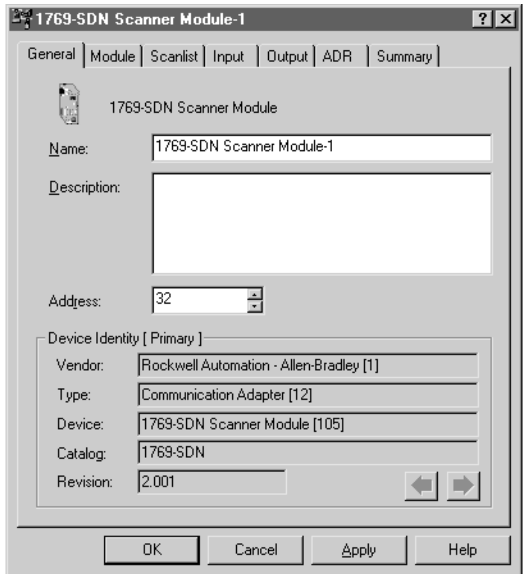
RSLogix 5000 software, version 12, includes a 1769-SDN profile. This profile provides two modifications to the previous method of using the generic 1769 profile to configure the 1769-SDN:

- The new profile separates the module status and the configuration information from the I/O data. The profile automatically creates one set of tags for module status and configuration and another set of tags for I/O data.
- The 1769-SDN profile uses DINT tags for I/O data. The generic profile used INT tags.

IMPORTANT	If you are converting a project from a 1769-L20, -L30 controller to a 1769-L3xx controller and the project contains a 1769-SDN, you might want to leave the generic profile for the 1769-SDN in the project rather than converting it to the new 1769-SDN profile. The new 1769-SDN profile uses DINTs instead of INTs for data and the scanlist is configured differently than for the generic profile.

Use RSNetWorx for DeviceNet software to create the scanlist.

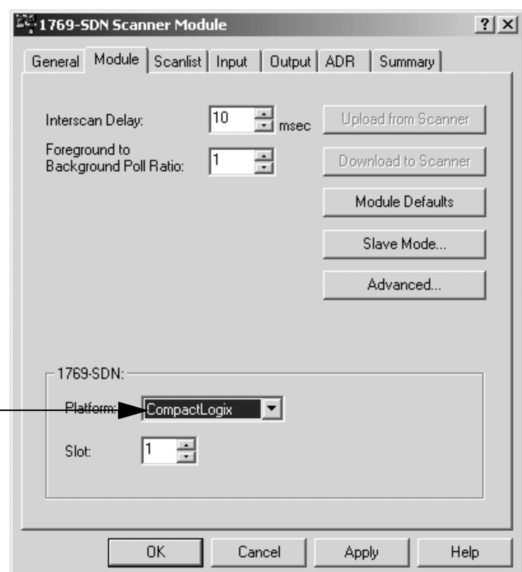
1. Right click on the 1769-SDN and choose Properties.



2. Select the Module tab.

3. Select CompactLogix from the Platform pulldown menu. This lets the software know that the scanner is being used with a CompactLogix controller. The scanlist will be mapped to coincide with the 1769-SDN profile in RSLogix 5000 software.

Select CompactLogix from this menu.

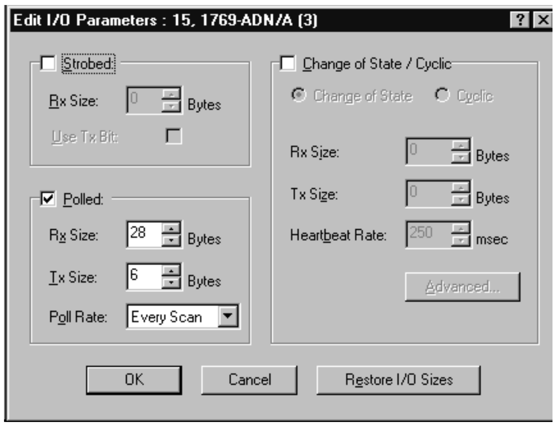


4. Select the slot number of the 1769-SDN module.

5. Click the Scanlist tab, then click Upload when prompted. The area on the left is called “Available Devices” and the area on the right is called “Scanlist”. The 1769-ADN adapter should be on the left.

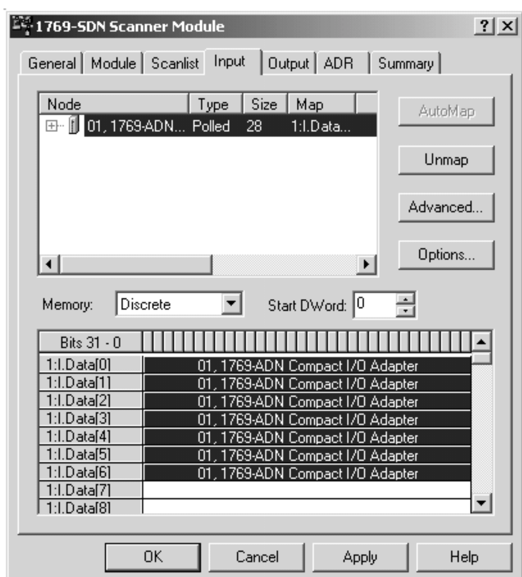
6. Click on the adapter, then click on the single arrow pointing to the right. This moves the adapter from Available Devices to the scanner’s scanlist.

7. Click on the Edit I/O Parameters button



8. Verify that the Rx Size and Tx Size are correct. The Tx (Transmit) and Rx (Receive) sizes correspond to the total number of output and input bytes noted from the adapter’s summary page. In this example, the scanner transmits 6 bytes to the adapter (output data) and receives 28 bytes from the adapter (input data). Click OK when finished with this screen.

9. Click on the Input tab.



10. Click Apply.

11. Click OK.

Mapping starts at word 0 for both the input and the output data image. The input status and output configuration words are no longer included with the I/O data scanlist. Use the status and configuration tags created in RSLogix 5000 software to read status or set configuration bits.

TIP

The input and output data being exchanged by the scanner and adapter is packed data. This means that there is no special structure to it that makes it obvious which I/O module it is associated with.

To establish which data is from which module, you must list the number of input and output words each module has. Then, based on its position in the I/O bank, you can determine where any module's data is in the controller's I/O tags.

Transferring data

There are 28 bytes of input data and 6 bytes of output data for this example. The I/O modules in the adapter's system are:

Table 5.3

Module	Input	Output
ADN Status Information (added by the 1769-ADN)	1 DINT word	0 words
1769-IA16	1/2 DINT word	0 words
1769-OB16	1/2 DINT word	1/2 DINT word
1769-IF4	3 DINT words	0 words
1769-OF2	2 DINT words	1 DINT word
Total Words	7 DINT words	1 1/2 DINT words
Total Bytes	28 bytes	6 bytes

The total is 7 DINT words or 28 input bytes. The first DINT word is adapter status, leaving 6 DINT words (24 bytes) for data. The input data maps to the controller's input data tag at the following word locations:

Table 5.4

Location	Description
Word 0	1769-ADN status information
Word 1	1769-IA16 module's input word
Word 1	1769-OB16 module's input data (output data echo)
Words 2-4	1769-IF4 module's input data
Words 5-6	1769-OF2 module's input data

The output data can be determined in a similar manner. This data begins with word 0 of the output tag in the controller as follows:

Table 5.5

Location	Description
Word 0	1769-OB16 module's output word
Words 0-1	1769-OF2 module's output words

Module command array

The module command array is the primary control interface between your control program and the module. In RSLogix 5000 software, the CommandRegister tag structure is as follows:

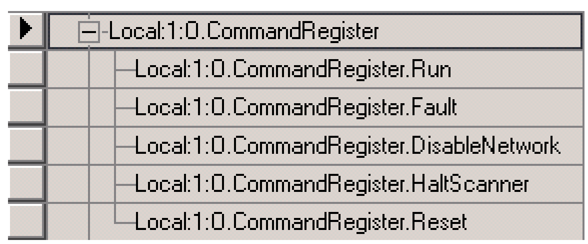


Table 5.6

Output Word	Bit	Description	Behavior
0	0	Run	This bit controls when the module scans its mapped slave devices. When set (1), the scanner will process I/O data as defined by its scanlist. To actually scan the network the Fault and Disable Network command bits must be clear (0).
	1	Fault	When set, the scanner's I/O mode will be Halt; messaging will still operate. The fault bit is primarily used to artificially set the slave devices into a fault state due to some event or condition within the control program.
	2	Disable Network	When set, the scanner is functionally removed from the network.
	3	HaltScanner	When set, the scanner stops scanning its mapped slave devices.
	4	Reset	Restarts access to the DeviceNet network.

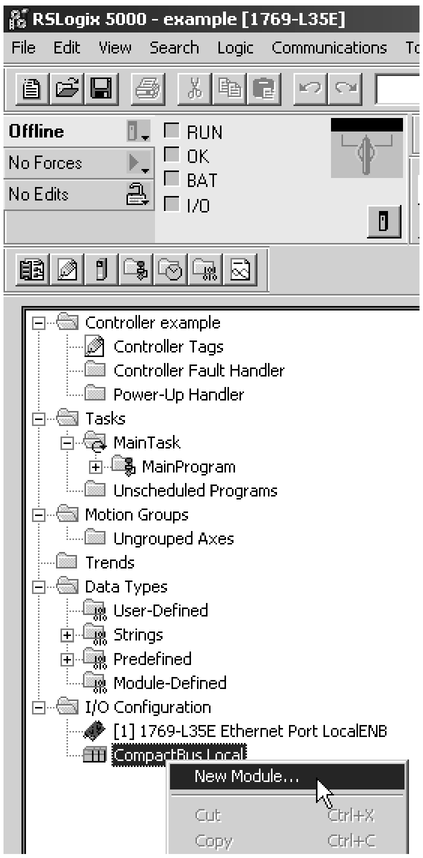
Download the scanner information to the 1769-SDN

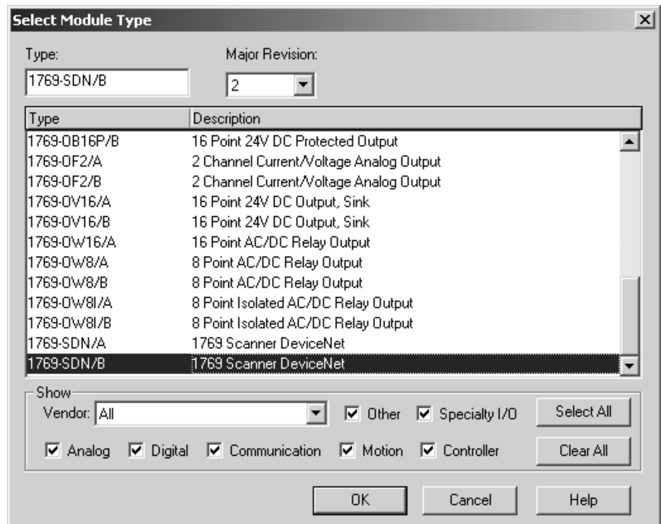
After you configure the scanlist, you need to download that information to the 1769-SDN module.

Step 3: Creating a project for the CompactLogix controller

1. In the Controller Organizer, select the CompactBus. Right-click the selected rail and select New Module.

2. Select the 1769-SDN/B module.



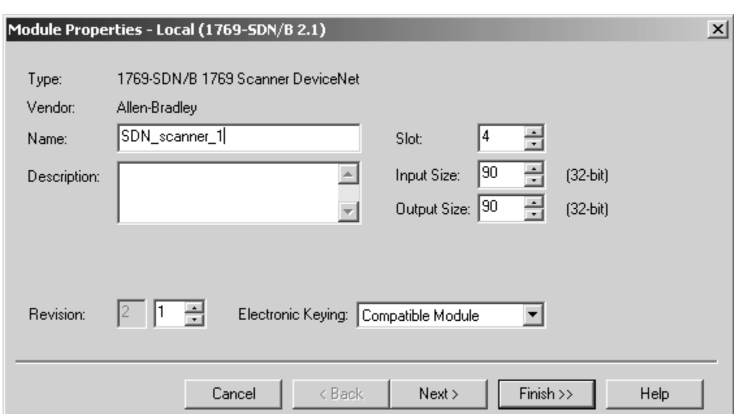


3. Click OK.

4. Configure the module. Use the module wizard to specify characteristics for the module.

5. Click Next to continue through the wizard.

6. Click Finish when you are done. The completed module appears in the Controller Organizer.



IMPORTANT

Version 12 of RSLogix 5000 software added a complete profile for configuring a 1769-SDN module in a CompactLogix system. To take advantage of this profile and the enhanced messaging capabilities of the 1769-SDN module:

- download and install new EDS files for the 1769-SDN module
- update the firmware of the 1769-SDN module

See the *CompactLogix Controller Release Notes*, publication 1769-RN006 for details on downloading and installing EDS files and firmware.

All tags for I/O modules are automatically created when the profiles for these modules are configured. Double click on Controller Tags in the controller organizer to view these tags. Each I/O module slot has Input, Output and Configuration tags created, if they apply. These tags are structured as:

Table 5.7

Tag	Definition
Local:s:I	s is the slot number I represents Input Data
Local:s:O	O represents Output Data
Local:s:C	C represents Configuration Data

If the 1769-SDN is in slot 1, the input addresses for the scanner are:

Table 5.8

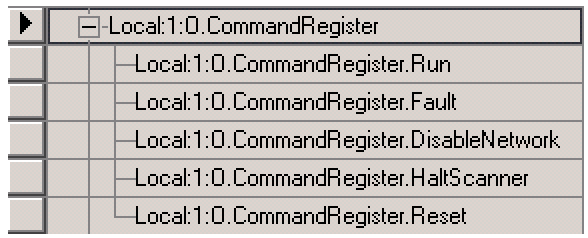
Tag	Definition
Local:1:I.Data[0]	1769-ADN Status Information
Local:1:I.Data[1]	Input Data from 1769-IA16
Local:1:I.Data[1]	Input (output echo) Data from 1769-OB16
Local:1:I.Data[2] through Local:3:I.Data[4]	Input Data from 1769-IF4
Local:1:I.Data[5] through Local:3:I.Data[6]	Input Data from 1769-OF2

This output addresses for the scanner are:

Table 5.9

Tag	Definition
Local:1:O.Data[0]	Output data for 1769-OB16
Local:1:O.Data[0] through Local:3:O.Data[1]	Output data for 1769-OF2

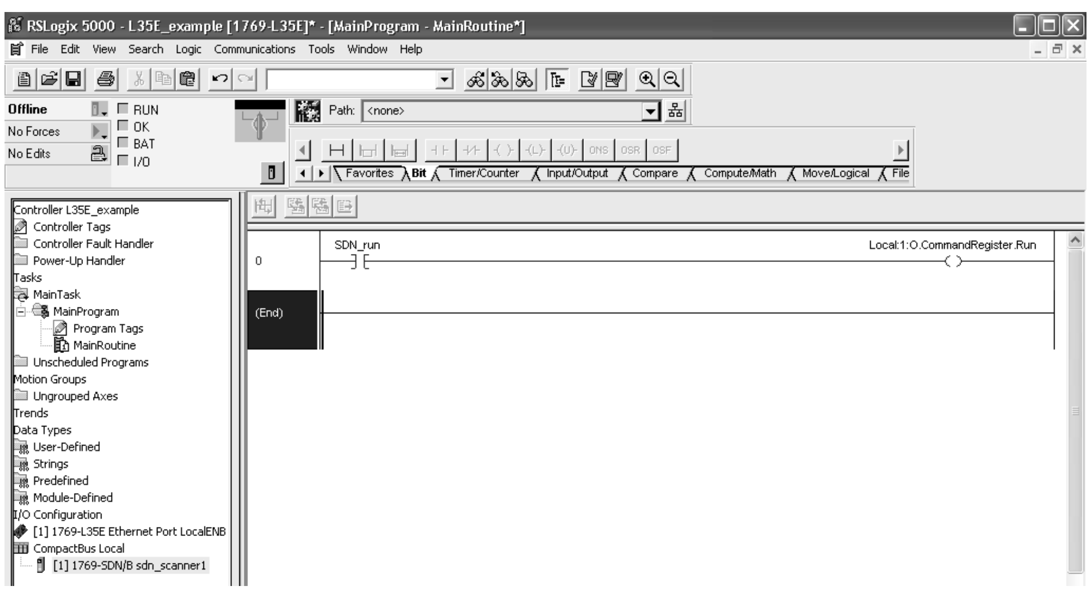
The controller uses the CommandRegister (Local:1:O.CommandRegister) to send commands to the scanner



Step 4: Enter program logic

The program for this example consists of a single rung that is used to place the scanner into the RUN mode.

To place the scanner in the Run mode when the CompactLogix controller is in the Run mode, either set “SDN_RUN” to a 1, or remove it from the program. When “SDN_RUN” is removed, the scanner’s Run bit is always in Run when the controller is in Run.



When your program is written, verify and save it, then download it to your controller to run and test your system.

Example 2: Bridging through Ethernet to DeviceNet

You can use the controller to bridge messages between devices; the controller supports one connected and one unconnected message between devices. The controller will only bridge messaging data (not I/O data), and there is limited buffering to store waiting messages that bridge networks.

IMPORTANT

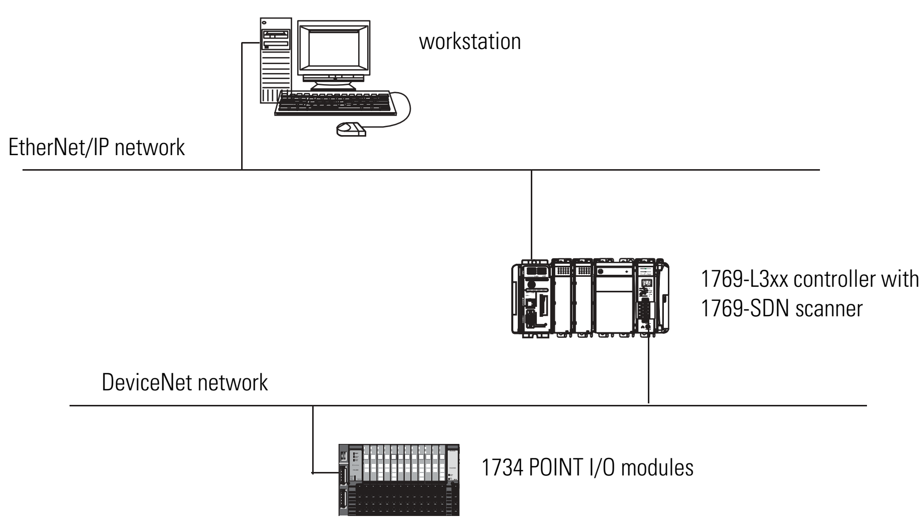
The update time of local I/O modules may increase when the controller is bridging messages.

Bridging over the CompactLogix controller should be targeted toward applications that are not real time dependent, such as RSLogix 5000 program downloads and ControlFlash updates.

The 1769-L32E, -L35E controller can bridge from the serial or EtherNet/IP port to DeviceNet. The 1769-L31 controller can bridge from either serial port to DeviceNet.

For example, a message originates at a workstation and bridges through a CompactLogix system to DeviceNet devices.

Figure 5.2



The CompactLogix controller can bridge these combinations of networks:

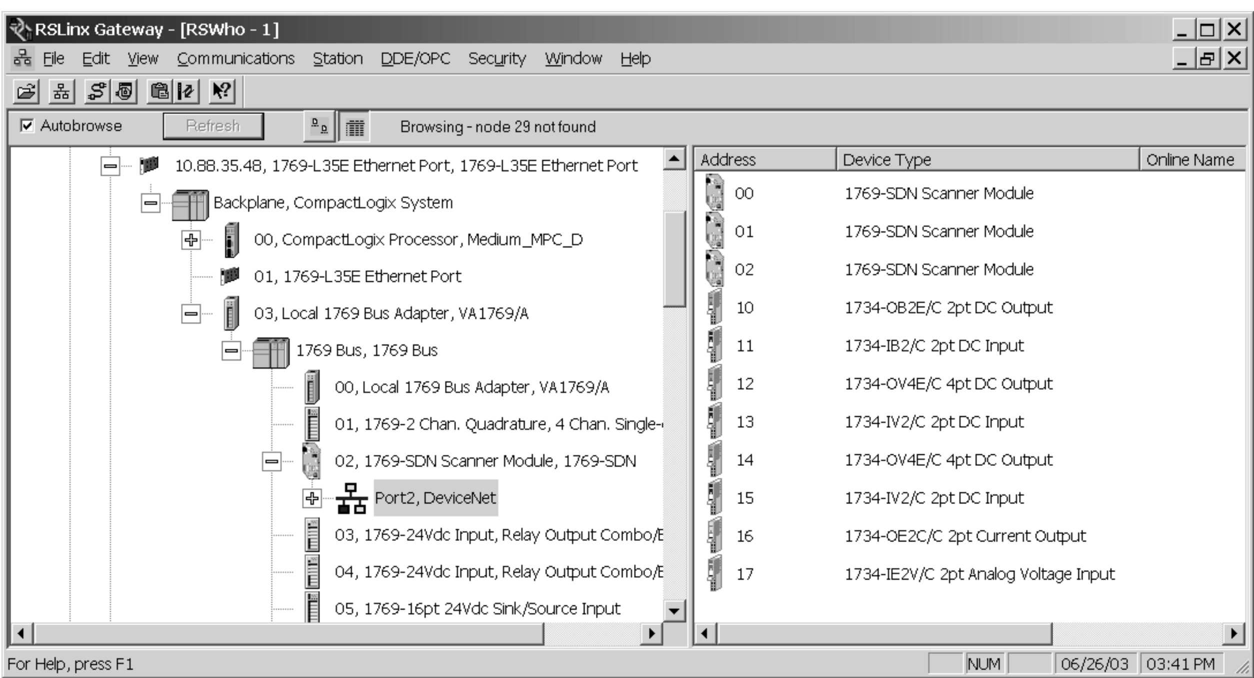
Table 5.10

Messages that originate on this network:	And end on this network:
EtherNet/IP	DeviceNet RS-232 serial
RS-232 serial	EtherNet/IP DeviceNet

Bridging from Ethernet to DeviceNet lets you use one workstation to program the CompactLogix controller on Ethernet, as well as to maintain DeviceNet devices via RSNetWorx for DeviceNet software

Maintaining DeviceNet devices via a bridge

Use RSNetWorx for DeviceNet software to manage your DeviceNet network and devices. This screen shows how you would navigate through an Ethernet-to-DeviceNet bridge to select specific devices. You navigate through the 1769 bus to select the 1769-SDN module to get to DeviceNet devices.



Sending a MSG instruction from the controller to a DeviceNet device

1. For Compact1, create a controller-scoped tag and select the MESSAGE data type.

2. Enter a MSG instruction.

   In this example logic, a message is sent when a specific condition is met. When count_send is set, send count_msg.

3. Configure the MSG instruction. On the Configuration tab:

For this item:	Specify:
Message Type	CIP Generic Read or CIP Generic Write
Source Tag	Tag containing the data to be transferred
Number of Elements	Number of array elements to transfer
Destination Tag	Tag to which the data will be transferred

4. On the Communication tab, specify the communication path.

   You must enter the communication path. If you want to send a MSG instruction to a 1734-OB3E module at node 10 in this bridging example, the communication path is:

Table 5.11

For this item:	Specify:
Communication Path	1,3,1,2,2,10 where: 1 is the virtual backplane of the CompactLogix controller 3 is slot number of the Local 1769 Bus Adapter 1 is the 1769 backplane 2 is the slot number of the 1769-SDN module 2 is the DeviceNet network 10 is the node number of the 1734-OB2E

If you send messages via DeviceNet, either local or through a bridge, program the MSG instructions sequentially. The 1769-SDN has limited buffering capability for MSG instructions.

Example 3: Bridging through ControlNet to DeviceNet

You can use the controller to bridge messages between devices; the controller supports one connected and one unconnected message between devices. The controller will only bridge messaging data (not I/O data), and there is limited buffering to store waiting messages that bridge networks.

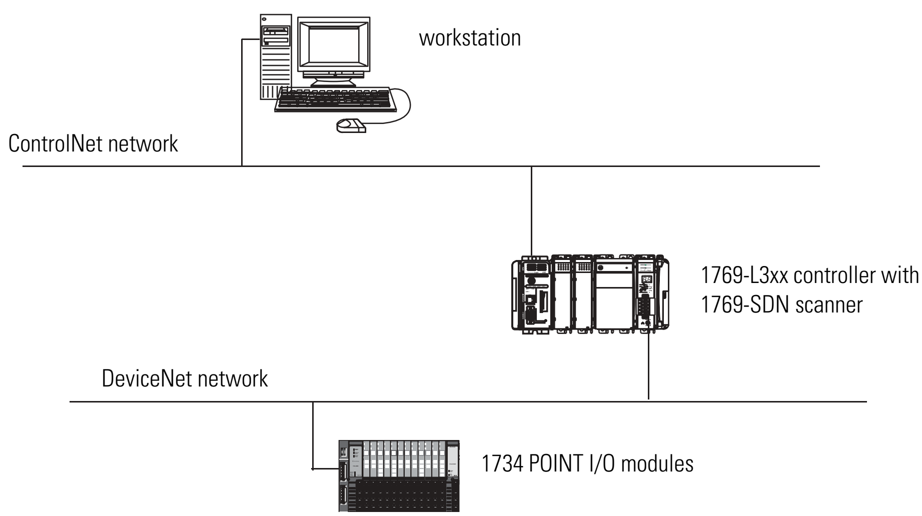
IMPORTANT

The update time of local I/O modules may increase when the controller is bridging messages.

Bridging over the CompactLogix controller should be targeted toward applications that are not real time dependent, such as RSLogix 5000 program downloads and ControlFlash updates.

The 1769-L35CR controller can bridge from the serial or ControlNet port to DeviceNet. For example, a message originates at a workstation and bridges through a CompactLogix system to DeviceNet devices.

Figure 5.3



The CompactLogix controller can bridge these combinations of networks:

Table 5.12

Messages that originate on this network:	And end on this network:
ControlNet	DeviceNet RS-232 serial
RS-232 serial	ControlNet DeviceNet

Bridging from ControlNet to DeviceNet lets you use one workstation to program the CompactLogix controller on ControlNet, as well as to maintain DeviceNet devices via RSNetWorx for DeviceNet software

Maintaining DeviceNet devices via a bridge

Use RSNetWorx for DeviceNet software to manage your DeviceNet network and devices. Navigate through an ControlNet-to-DeviceNet bridge to select specific devices. You navigate through the 1769 bus to select the 1769-SDN module to get to DeviceNet devices.

Sending a MSG instruction from the controller to a DeviceNet device

1. For Compact1, create a controller-scoped tag and select the MESSAGE data type.

2. Enter a MSG instruction.

   In this example logic, a message is sent when a specific condition is met. When count_send is set, send count_msg.

3. Configure the MSG instruction. On the Configuration tab:

For this item:	Specify:
Message Type	CIP Generic Read or CIP Generic Write
Source Tag	Tag containing the data to be transferred
Number of Elements	Number of array elements to transfer
Destination Tag	Tag to which the data will be transferred

4. On the Communication tab, specify the communication path.

   You must enter the communication path. If you want to send a MSG instruction to a 1734-OB3E module at node 10 in this bridging example, the communication path is:

Table 5.13

For this item:	Specify:
Communication Path	1,3,1,2,2,10 where: 1 is the virtual backplane of the CompactLogix controller 3 is slot number of the Local 1769 Bus Adapter 1 is the 1769 backplane 2 is the slot number of the 1769-SDN module 2 is the DeviceNet network 10 is the node number of the 1734-OB2E

If you send messages via DeviceNet, either local or through a bridge, program the MSG instructions sequentially. The 1769-SDN has limited buffering capability for MSG instructions.

Communicating with Devices on a Serial Link

Using This Chapter

The CompactLogix controller can communicate with devices on a serial link.

Table 6.1

Default Communication Configuration

The CompactLogix controller has the default serial configuration listed in Table 6.2:

Table 6.2

Parameter:	Channel 0 Default:	Channel 1 Default (1769-L31 only):
Baud Rate	19.2K	19.2K
Parity	none	none
Station Address	0	0
Control Lines	no handshaking	no handshaking
Error Detection	BCC	BCC
Embedded Responses	auto detect	auto detect
Duplicate Packet (Message) Detect	enabled	enabled
ACK Timeout	50 counts	50 counts
NAK Receive Limit	3 retries	3 retries
ENQ Transmit Limit	3 retries	3 retries
Data Bits	8	8
Stop Bits	1	1
Protocol	DF1 full-duplex	DF1 full-duplex

TIP Node Address is part of the default configuration. Changing the node address will result in the DCH0 LED turning off.

System protocol options

The serial port supports:

- DF1 full-duplex
- DF1 master
- DF1 slave
- DH-485
- ASCII (user mode) channel 0 only
- Modbus (user mode protocol) via ladder logic routine

Modbus support

To use Logix5000 controllers on Modbus RTU, you connect through the serial port and execute a specific ladder logic routine. The ladder logic routine is available on the CD for RSLogix 5000 Enterprise programming software. For more information, see Using Logix5000 Controllers as Masters or Slaves on Modbus Application Solution, publication CIG-AP129A-EN-P.

Using the Channel 0 default communication push button

Use the Channel 0 Default Communication Push Button to change from the user-defined communication configuration to the default communications configuration. *Hold the button* until the Channel 0 Default Communications (DCH0) LED turns on (green, steady) showing that the default communication configuration is active.

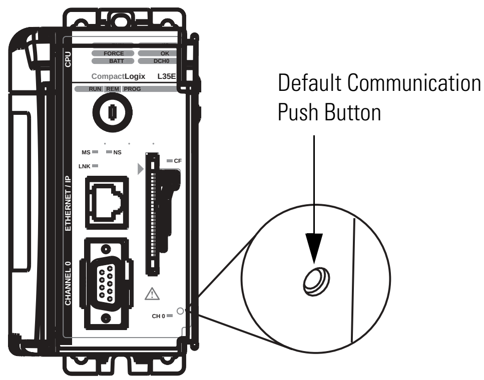
TIP

Before pressing the Default Communication Push Button, be sure to note the present communication configuration. Pushing the Default Communication Push Button resets all configured parameters back to their default settings. To return the channel to its user-configured parameters, you must enter them manually while online with the controller or download them as part of a Logix Project file.

To accomplish this online, enter the Controller Properties screen under the Serial Port, System Protocol and User Protocol tabs.

The Default Communication Push Button is located on the front of the controller in the lower right corner.

Figure 6.1



Configuring Your System for a Serial Link

For the CompactLogix controller to operate on a serial network, you need:

- a workstation with a serial port
- RSLinx software to configure the serial communication driver
- RSLogix5000 programming software to configure the serial port of the controller

IMPORTANT	Limit the length of serial (RS-232) cables to 15.2m (50 ft.).

ATTENTION	The CompactLogix controller is grounded through its DIN rail or mounting foot. It is important that you understand the workstation's grounding system before connecting it to the controller.

Step 1: Configure the hardware

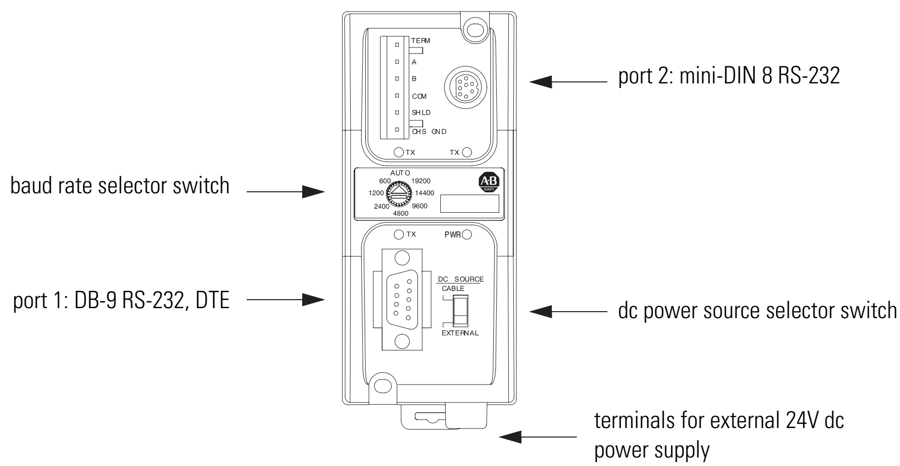
Channel 0 on the CompactLogix controllers is fully isolated and does not need a separate isolation device. Channel 1 on the 1769-L31 is a non-isolated serial port.

1. Determine whether you need an isolator

   If you connect channel 1 of the 1769-L31 controller to a modem or an ASCII device, consider installing an isolator between the controller and modem or ASCII device. An isolator is also recommended when connecting the controller directly to a programming workstation.

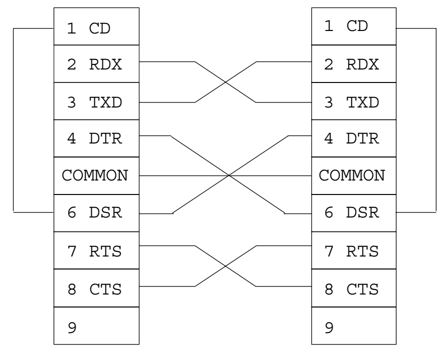
   One possible isolator is the 1761-NET-AIC interface converter.

Figure 6.2



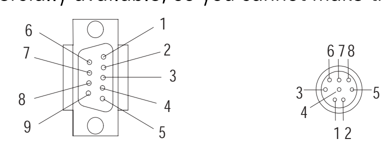
2. Select the appropriate cable.

<table>
<tr><th>Are you using an isolator?</th><th>Use this cable:</th></tr>
<tr><td>no</td><td>
The 1756-CP3 cable attaches the controller directly to the controller.



If you make your own cable, it must be shielded and the shields must be tied to the metal shell (that surrounds the pins) on both ends of the cable.

You can also use a 1747-CP3 cable (from the SLC product family). This cable has a taller right-angle connector housing than the 1756-CP3 cable.
</td></tr>
<tr><td>yes</td><td>
The 1761-CBL-AP00 cable (right-angle connector to controller) or the 1761-CBL-PM02 cable (straight connector to the controller) attaches the controller to port 2 on the 1761-NET-AIC isolator. The mini-DIN connector is not commercially available, so you cannot make this cable.



DB-9 right-angle or straight cable end 8-pin, mini-DIN cable end

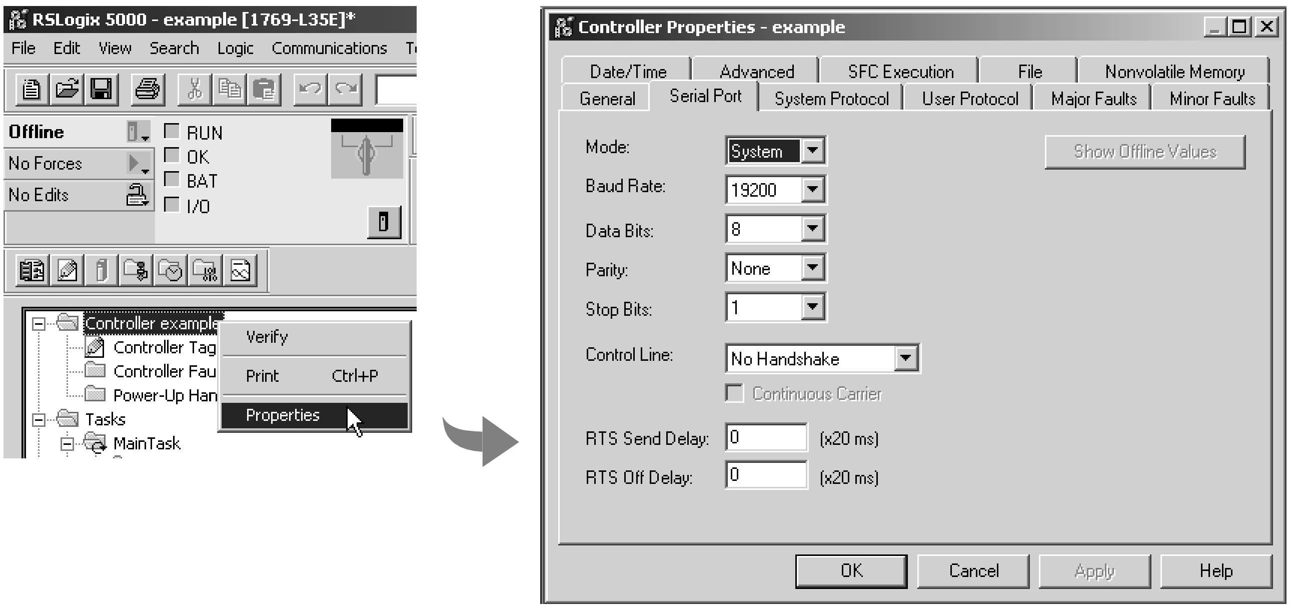
<table>
<tr><th>Pin:</th><th>DB-9 end:</th><th>Mini-DIN end:</th></tr>
<tr><td>1</td><td>DCD</td><td>DCD</td></tr>
<tr><td>2</td><td>RxD</td><td>RxD</td></tr>
<tr><td>3</td><td>TxD</td><td>TxD</td></tr>
<tr><td>4</td><td>DTR</td><td>DTR</td></tr>
<tr><td>5</td><td>ground</td><td>ground</td></tr>
<tr><td>6</td><td>DSR</td><td>DSR</td></tr>
<tr><td>7</td><td>RTS</td><td>RTS</td></tr>
<tr><td>8</td><td>CTS</td><td>CTS</td></tr>
<tr><td>9</td><td>na</td><td>na</td></tr>
</table>
</td></tr>
</table>

3. Connect the appropriate cable to the serial port.

Step 2: Configure the serial port of the controller

1. In RSLogix 5000 programming software, select the Edit →Controller folder.

2. On the Serial Port tab, specify the appropriate serial communication configuration.



3. On the System Protocol tab, select the appropriate DF1 communication mode for point-to-point or master/slave communications. Or on the User Protocol tab, select ASCII to communicate with an ASCII device.

Specifying serial port characteristics

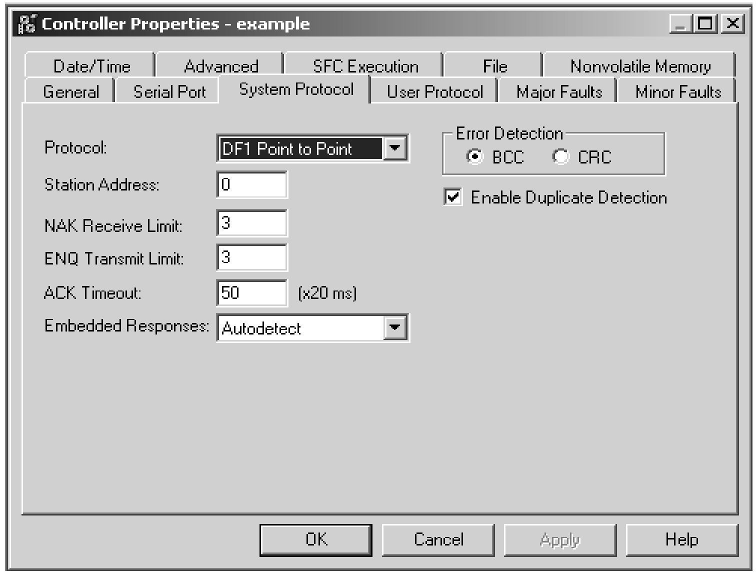
Specify the characteristics described in Table 6.3 on the Serial Port tab (default values are shown in bold):

Table 6.3

Characteristic:	Description (default is shown in bold):
Mode	Select **System** (for DF1 and DH485 communication) or User mode (for ASCII communication).
Baud rate	Specifies the communication rate for the serial port. Select a baud rate that all devices in your system support. Select 110, 300 600, 1200, 2400, 4800, 9600, **19200**, 38400 Kbps. Note: 38400 Kbps only in DF1 mode
Parity	Specifies the parity setting for the serial port. Parity provides additional message-packet error detection. Select **None** or Even.
Data bits	Specifies the number of bits per message packet. Select **8**.
Stop bits	Specifies the number of stop bits to the device with which the controller is communicating. Select **1** or 2.
Control line	Specifies the mode in which the serial driver operates. Select **No Handshake**, Full-Duplex, Half-Duplex with Continuous Carrier, or Half-Duplex without Continuous Carrier. If you are not using a modem, select No Handshake. If both modems in a point-to-point link are full-duplex, select Full-Duplex for both controllers. If the master modem is full-duplex and the slave modem is half-duplex, select Full-Duplex for the master controller and select Half-Duplex with Continuous Carrier for the slave controller. If all the modems in the system are half-duplex, select Half-Duplex without Continuous Carrier for the controller.
RTS send delay(1)	Enter a count that represents the number of 20 ms periods of time that elapse between the assertion of the RTS signal and the beginning of a message transmission. This time delay lets the modem prepare to transmit a message. The CTS signal must be high for the transmission to occur. The range is **0** to +32767 periods.
RTS off delay(1)	Enter a count that represents the number of 20 ms periods of time that elapse between the end of a message transmission and the de-assertion of the RTS signal. This time delay is a buffer to make sure the modem successfully transmits the entire message. The range is **0** to +32767 periods. Normally leave this setting at zero.

(1) This parameter is especially useful for communicating via radio modems.

Specifying system protocol characteristics



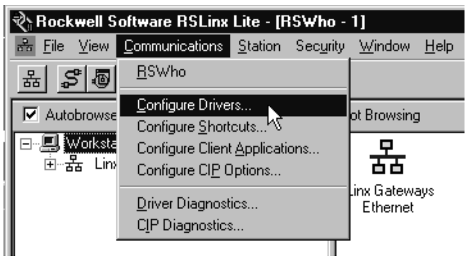
The available system modes are described in Table 6.4:

Table 6.4

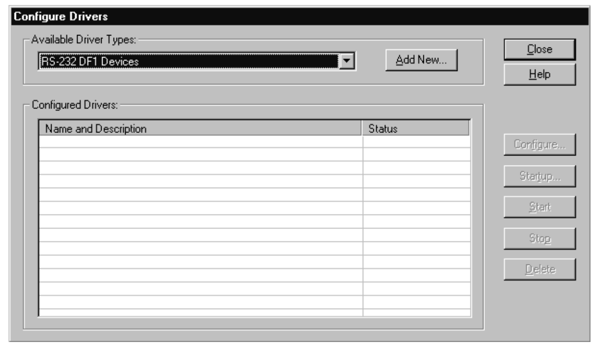
Use this mode:	For:	See page:
DF1 point-to-point	communication between the controller and one other DF1-protocol-compatible device. This is the default system mode. This mode is typically used to program the controller through its serial port.	6-10
DF1 master mode	control of polling and message transmission between the master and slave nodes. The master/slave network includes one controller configured as the master node and as many as 254 slave nodes. Link slave nodes using modems or line drivers. A master/slave network can have node numbers from 0 to 254. Each node must have a unique node address. Also, at least 2 nodes must exist to define your link as a network (1 master and 1 slave station are the two nodes).	6-13
DF1 slave mode	using a controller as a slave station in a master/slave serial communication network. When there are multiple slave stations on the network, link slave stations using modems or line drivers to the master. When you have a single slave station on the network, you do not need a modem to connect the slave station to the master. You can configure the control parameters for no handshaking. You can connect 2 to 255 nodes to a single link. In DF1 slave mode, a controller uses DF1 half-duplex protocol. One node is designated as the master and it controls who has access to the link. All the other nodes are slave stations and must wait for permission from the master before transmitting.	6-13
User mode (Channel 0 only)	communicating with ASCII devices. This requires your program logic to use the ASCII instructions to read and write data from and to an ASCII device.	6-16
DH-485	communicating with other DH-485 devices multi-master, token passing network allowing programming and peer-to-peer messaging.	7-1

Step 3: Configure the serial communication driver

1. In RSLinx software, select Communication →Configure Driver.

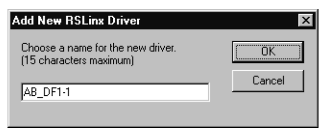


2. From the Available Driver Types list, select"RS-232 DF1 Devices".



3. Click Add New.

4. Specify a name for the driver.

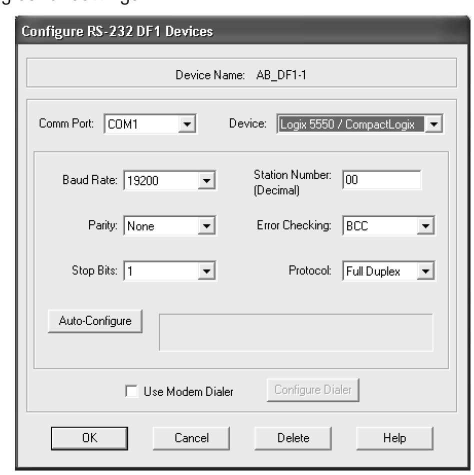


5. Specify the appropriate communication settings.

6. Select the "Logix/CompactLogix" and specify the COM port.

7. Click Autoconfigure to have the software determine the remaining serial settings.

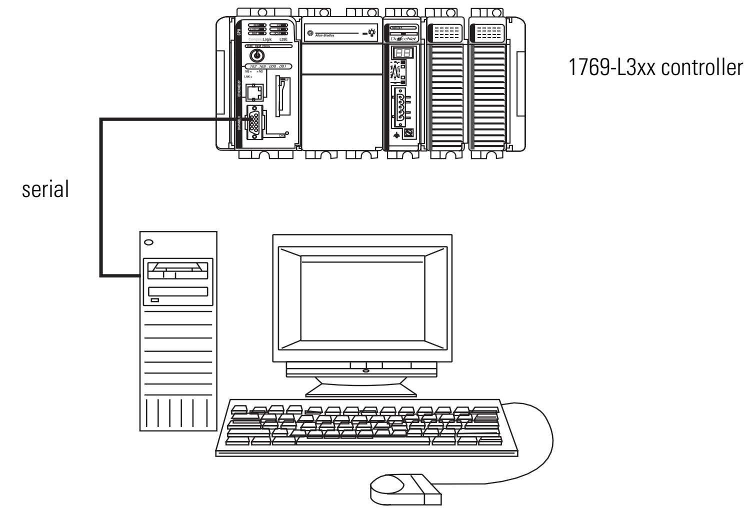
8. Click OK.



Example 1: Workstation Directly Connected to a CompactLogix Controller

In the Figure 6.3 example, a workstation directly connects to a CompactLogix controller over a serial link. This is useful for downloading a controller project directly to the controller.

Figure 6.3



This type of protocol supports simultaneous transmission between two devices in both directions. The DF1 point-to-point protocol controls message flow, detects and signals errors, and retries if errors are detected.

Configuring a DF1 point-to-point station

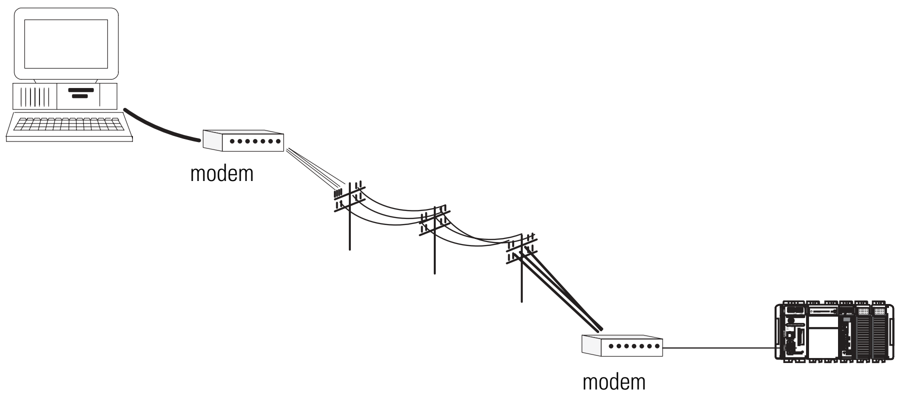
Table 6.5

This field:	Description:
Station address	The station address for the serial port on the DF1 point-to-point network. Enter a valid DF1 address (0 to 254). Address 255 is reserved for broadcast messages. The default is 0.
NAK receive limit	Specifies the number of NAKs the controller can receive in response to a message transmission. Enter a value 0 to 127. The default is 3.
ENQ transmit limit	Specifies the number of inquiries (ENQs) you want the controller to send after an ACK timeout. Enter a value 0 to 127. The default is 3.
ACK timeout	Specifies the amount of time you want the controller to wait for an acknowledgment to its message transmission. Enter a value 0 to 32767. Limits are defined in 20 ms intervals. The default is 50 (1000 ms).
Embedded response	Specifies how to enable embedded responses. Select Autodetect (enabled only after receiving one embedded response) or Enabled. The default is Autodetect.
Error detection	Select BCC or CRC error detection. Configure both stations to use the same type of error checking. **BCC:** the controller sends and accepts messages that end with a BCC byte for error checking. BCC is quicker and easier to implement in a computer driver. This is the default. **CRC:** the controller sends and accepts messages with a 2-byte CRC for error checking. CRC is a more complete method.
Enable duplicate detection	Select whether or not the controller should detect duplicate messages. The default is duplicate detection enabled.

Example 2: Workstation Remotely Connected to a CompactLogix Controller

In the Figure 6.4 example, a workstation remotely connects to a CompactLogix controller over a serial link. A modem is connected to the controller to provide remote access.

Figure 6.4



If you use a modem to remotely connect the controller to one workstation, use DF1 point-to-point (full-duplex) protocol, as in the previous example.

Master/Slave communication methods

Half-duplex DF1 protocol

Half-duplex master/slave protocol is a SCADA protocol, consisting of 1 master and up to 254 slaves. Typically, the master polls all of the slaves for data in a round-robin fashion, using RF modems, leased-line modems, or any similar media.

A master station can communicate with a slave station in two ways:

Table 6.6

Name:	This method:	Benefits:
standard communication mode	initiates polling packets to slave stations according to their position in the polling array(s). Polling packets are formed based on the contents of the normal poll array and the priority poll array.	This communication method is most often used for point-to-multipoint configurations. This method provides these capabilities: • slave stations can send messages to the master station (polled report-by-exception) • slave stations can send messages to each other via the master (slave-to-slave transfers) • master maintains an active station array The poll array resides in a user-designated data file. You can configure the master: • to send messages during its turn in the poll array *or* • for between-station polls (master transmits any message that it needs to send before polling the next slave station) In either case, configure the master to receive multiple messages or a single message per scan from each slave station.
message-based communication mode	initiates communication to slave stations using only user-programmed message (MSG) instructions. Each request for data from a slave station must be programmed via a MSG instruction. The master polls the slave station for a reply to the message after waiting a user-configured period of time. The waiting period gives the slave station time to formulate a reply and prepare the reply for transmission. After all of the messages in the master's message-out queue are transmitted, the slave-to-slave queue is checked for messages to send.	If your application uses satellite transmission or public switched-telephone-network transmission, consider choosing message-based communication. Communication to a slave station can be initiated on an as-needed basis. Also choose this method if you need to communicate with non-intelligent remote terminal units (RTUs).

Configuring a DF1 slave station

Table 6.7

This field:	Description:
Station address	The station address for the serial port on the DF1 slave. Enter a valid DF1 address (0 to 254). Address 255 is reserved for broadcast messages. The default is 0.
Transmit retries	The number of times the remote station retries a message after the first attempt before the station declares the message undeliverable. Enter a value 0 to 127. The default is 3.
Slave poll timeout	Specifies the amount of time the slave station waits to be polled by a master before indicating a fault. Enter a value 0 to 32767. Limits are defined in 20 ms intervals. The default is 3000 (60,000 ms).
EOT suppression	Select whether or not to suppress sending EOT packets in response to a poll. The default is *not* to suppress sending EOT packets.
Error detection	Select BCC or CRC error detection. Configure both stations to use the same type of error checking. **BCC:** the controller sends and accepts messages that end with a BCC byte for error checking. BCC is quicker and easier to implement in a computer driver. This is the default. **CRC:** the controller sends and accepts messages with a 2-byte CRC for error checking. CRC is a more complete method.
Enable duplicate detection	Select whether or not the controller should detect duplicate messages. The default is duplicate detection enabled.

Configuring a DF1 master station

Table 6.8

This field:	Description:
Station address	The station address for the serial port on the DF1 master. Enter a valid DF1 address (0 to 254). Address 255 is reserved for broadcast messages. The default is 0.
Transmit retries	Specifies the number of times a message is retried after the first attempt before being declared undeliverable. Enter a value 0 to 127. The default is 3.
ACK timeout	Specifies the amount of time you want the controller to wait for an acknowledgment to its message transmission. Enter a value 0 to 32767. Limits are defined in 20ms intervals. The default is 50 (1000 ms).
Reply message wait	**Message-based polling mode only** Specifies the amount of time the master station waits after receiving an ACK to a master-initiated message before polling the slave station for a reply. Enter a value 0 to 65535. Limits are defined in 20ms intervals. The default is 5 (100 ms).

Table 6.8

This field:	**Description:**
Polling mode	Select one of these: • Message Based (slave cannot initiate messages) • Message Based (slave can initiate messages) - default • Standard (multiple message transfer per node scan) • Standard (single message transfer per node scan)
Master transmit	**Standard polling modes only** Select when the master station sends messages: • between station polls (default) • in polling sequence
Normal poll node tag	**Standard polling modes only** An integer tag array that contains the station addresses of the slave stations. Create a single-dimension array of data type INT that is large enough to hold all the normal station addresses. The minimum size is three elements. This tag must be controller-scoped. The format is: *list[0]* contains total number of stations to poll *list[1]* contains address of station currently being polled *list[2]* contains address of first slave station to poll *list[3]* contains address of second slave station to poll *list[n]* contains address of last slave station to poll
Normal poll group size	**Standard polling modes only** The number of stations the master station polls after polling all the stations in the priority poll array. Enter 0 (default) to poll the entire array.
Priority poll node tag	**Standard polling modes only** An integer tag array that contains the station addresses of the slave stations you need to poll more frequently. Create a single-dimension array of data type INT that is large enough to hold all the priority station addresses. The minimum size is three elements. This tag must be controller-scoped. The format is: *list[0]* contains total number of stations to be polled *list[1]* contains address of station currently being polled *list[2]* contains address of first slave station to poll *list[3]* contains address of second slave station to poll *list[n]* contains address of last slave station to poll

Table 6.8

This field:	Description:
Active station tag	**Standard polling modes only** An array that stores a flag for each of the active stations on the DF1 link. Both the normal poll array and the priority poll array can have active and inactive stations. A station becomes inactive when it does not respond to the master's poll. Create a single-dimension array of data type SINT that has 32 elements (256 bits). This tag must be controller-scoped.
Error detection	Select BCC or CRC error detection. Configure both stations to use the same type of error checking. **BCC:** the controller sends and accepts messages that end with a BCC byte for error checking. BCC is quicker and easier to implement in a computer driver. This is the default. **CRC:** the controller sends and accepts messages with a 2-byte CRC for error checking. CRC is a more complete method.
Enable duplicate detection	Select whether or not the controller should detect duplicate messages. The default is duplicate detection enabled.

If You Choose One of the Standard Polling Modes

The master station polls the slave stations in this order:

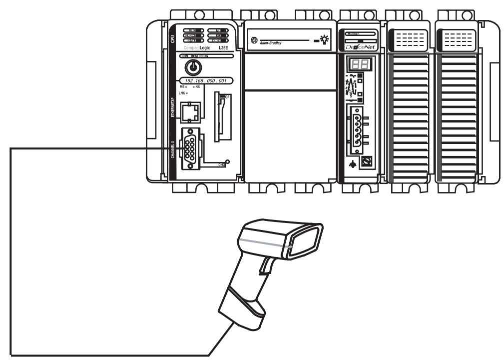
1. all stations that are active in the priority poll array
2. one station that is inactive in the priority poll array
3. the specified number (normal poll group size) of active stations in the normal poll array
4. one inactive station, after all the active stations in the normal poll array have been polled

Use the programming software to change the display style of the active station array to binary so you can view which stations are active.

Example 3: CompactLogix Controller Connected to a Bar Code Reader

In the Figure 6.5 example, a workstation connects to a bar code reader. Channel 0 of the CompactLogix controllers supports ASCII. A bar code reader is an ASCII device, so you configure the serial port differently than in the previous examples. Configure the serial port for User mode, rather than the system mode.

Figure 6.5

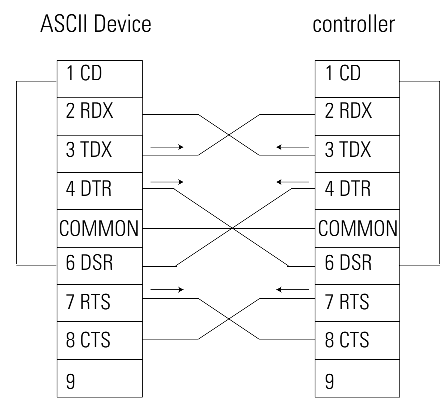
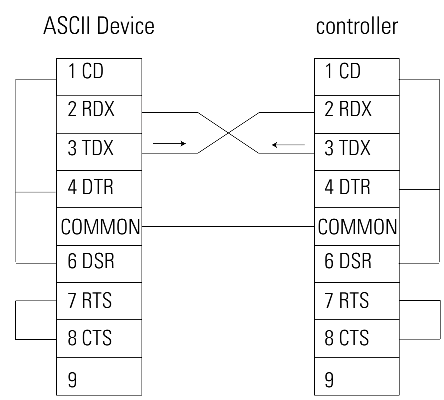


Connect the ASCII device to the controller

To connect the ASCII device to the Channel 0 serial port of the controller:

1. For the serial port of the ASCII device, determine which pins send signals and which pins receive signals.

2. Connect the sending pins to the corresponding receiving pins and attach jumpers:

If the communications hardware handshaking is:	Then wire the connectors as follows:
enabled	
disabled	

3. Attach the cable shield to both connectors and tie the cable to both connectors.

4. Connect the cable to the controller and the ASCII device.

The following table lists the default serial port configuration settings for the ASCII protocol. You specify these settings on the User Protocol tab under Controller Properties.

Configuring User mode

Table 6.9

This field:	Description:
Buffer size	Specify the maximum size (in bytes) of the data array you plan to send and receive. The default is 82 bytes.
Termination characters	Specify the characters you will use to designate the end of a line. The default characters are '$r' and '$FF'.
Append characters	Specify the characters you will append to the end of a line. The default characters are '$r' and '$l'.[1]
XON/XOFF	Select whether or not to regulate the flow of incoming data. The default is disabled.
Echo mode	Select whether or not to echo data back to the device from which it was sent. The default is disabled.
Delete mode	Select Ignore, CTR, or Printer for the delete mode. The default is Ignore.

(1) IEC 1131-3 representation for carriage return and line feed.

Programming ASCII instructions

ASCII instructions are used to communicate with ASCII devices that you connect to channel 0. Your RSLogix5000 programming software CDROM includes programming examples using ASCII instructions.

For information about using these examples, see the *Logix5000 Controllers General Instruction Set Reference Manual*, publication 1756-RM003.

Example 4: Bridging through the Serial Port

You can use the controller to bridge between networks; the controller supports one connected and one unconnected message between devices. The controller will only bridge messaging data (not I/O data), and there is limited buffering to store waiting messages that bridge networks.

You can bridge from serial to Ethernet or from serial to DeviceNet.

IMPORTANT	The update time of local I/O modules may increase when the controller is bridging messages. Bridging over the CompactLogix controller should be targeted toward applications that are not real time dependent, such as RSLogix 5000 program downloads and ControlFlash updates.

IMPORTANT	In the 1769-L31 controller, you cannot bridge from one serial port to the other serial port.

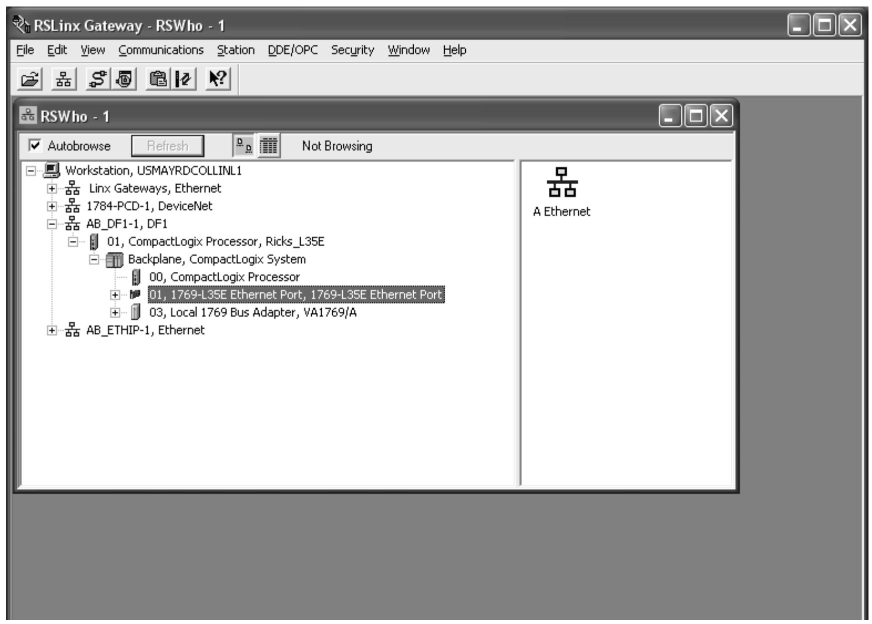
For example, you can use RSLogix 5000 software via a serial-to-Ethernet bridge to set the IP address of the EtherNet/IP port of the controller.

1. Make sure the controller is installed and running.
2. Connect to the controller via the serial connection.
3. Start RSLinx software. The RSWho window opens.

4. Navigate from the RSWho window to the EtherNet/IP port of the CompactLogix controller.

   Starting with the serial driver (AB_DF1-1 in this example), you can locate the CompactLogix controller. From there, expand the backplane of the CompactLogix system and you can see the EthetNet/IP port.

   Right-click on the Ethernet port (not the controller) and select Module Configuration



Communicating with Devices on a DH-485 Link

Using This Chapter

When using a CompactLogix controller it is recommended that you use NetLinx networks (EtherNet/IP, ControlNet, or DeviceNet) because excessive traffic on a DH-485 network may make it impractical to connect to a CompactLogix controller with RSLogix 5000 programming software. CompactLogix processors fully support the DH-485 protocol, but using the recommended NetLinx networks is more practical.

The DH-485 protocol uses RS-485 half-duplex as its physical interface. (RS-485 is a definition of electrical characteristics; it is *not* a protocol.) You can configure the RS-232 port of the CompactLogix controller to act as a DH-485 interface. By using a 1761-NET-AIC and the appropriate RS232 cable (1756-CP3 or 1747-CP3), a CompactLogix controller can send and receive data on a DH-485 network.

Table 7.1

IMPORTANT	A DH-485 network consists of multiple cable segments. Limit the total length of all the segments to 1219m (4000 ft.).

Configuring Your System for a DH-485 Link

For the CompactLogix controller to operate on a DH-485 network, you need:

- a 1761-NET-AIC interface converter for each CompactLogix controller you want to put on the DH-485 network.

  You can have two controllers per one 1761-NET-AIC converter, but you need a different cable for each controller. Connect one controller to port 1 (9-pin connector) and one controller to port 2 (mini-DIN connector).

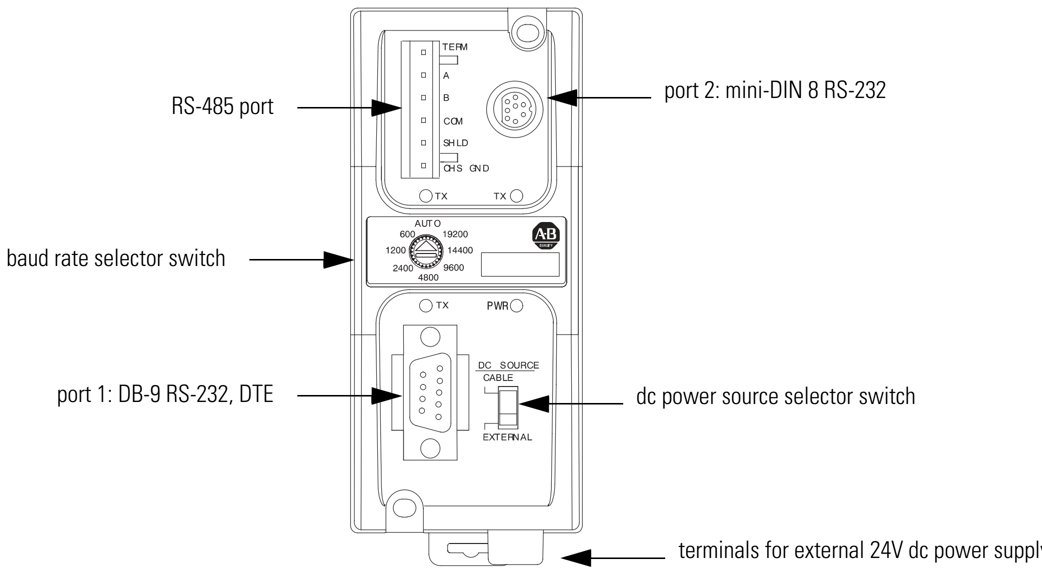
- RSLogix 5000 programming software to configure the serial port of the controller for DH-485 communications.

When attempting to go online or upload/download a program using the Communications/Who Active window in RSLogix 5000 software, disable the Autobrowse feature to minimize traffic from RSLogix 5000 software on the DH-485 network.

Step 1: Configure the hardware

The RS-232 port is built-in to the front of the CompactLogix controller. The 1769-L31 controller has two serial ports. Connect the serial port to an RS-232-to-RS-485 interface converter. One possible converter is the 1761-NET-AIC interface converter.

Figure 7.1



Connect the serial port of the CompactLogix controller to either port 1 or port 2 of the 1761-NET-AIC converter. Use the RS-485 port to connect the converter to the DH-485 network.

The cable you use to connect the controller depends on the port you use on the 1761-NET-AIC converter.

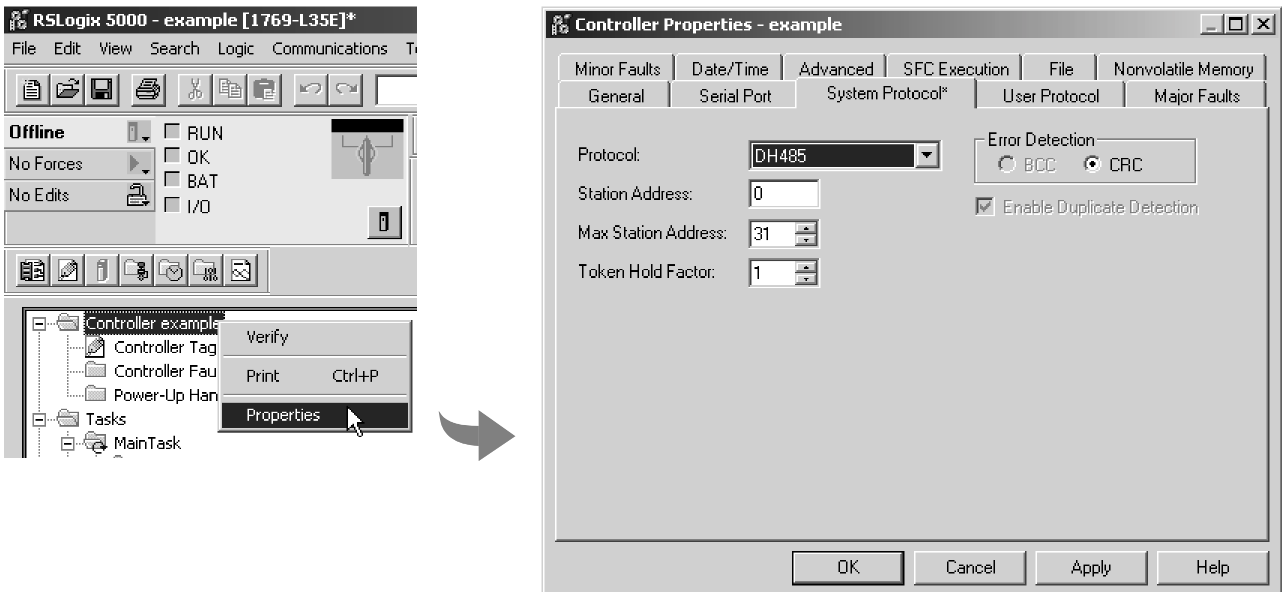
Table 7.2

If you connect to this port:	Use this cable:
port 1 DB-9 RS-232, DTE connection	1747-CP3 or 1761-CBL-AC00
port 2 mini-DIN 8 RS-232 connection	1761-CBL-AP00 or 1761-CBL-PM02

Step 2: Configure the DH-485 port of the controller

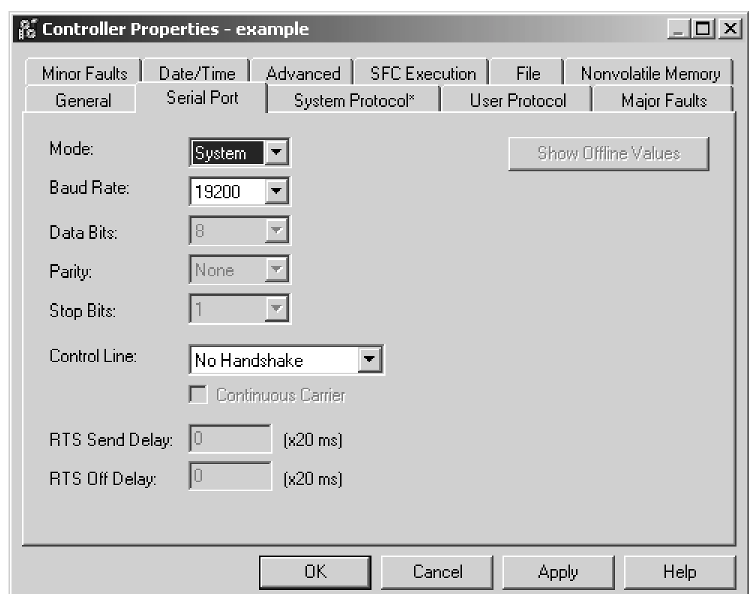
1. In RSLogix 5000 programming software, right-click on the Controller folder to select Properties.

2. On the System Protocol tab, specify the appropriate serial communication configuration.



3. On the Serial Port tab, specify the appropriate communication settings.

The grayed out settings are selections that do not apply to a DH-485 network.



Specify the characteristics described in Table 7.3 on the Serial Port tab (default values are shown in bold):

Table 7.3

Characteristic:	**Description (default is shown in bold):**
Baud Rate	Specifies the communication rate for the DH-485 port. All devices on the same DH-485 network must be configured for the same baud rate. Select 9600 or **19200** Kbps.
Node Address	Specifies the node address of the CompactLogix controller on the DH-485 network. Select a number **1**-31 decimal, inclusive. To optimize network performance, assign node addresses in sequential order. Initiators, such as personal computers, should be assigned the lowest address numbers to minimize the time required to initialize the network.
Token Hold Factor	Specifies the number of messages sent per token possession. Select a number **1**-4, inclusive.
Maximum Node Address	Specifies the maximum node address of all the devices on the DH-485 network. Select a number 1-**31** decimal, inclusive. To optimize network performance, make sure: • the maximum node address is the highest node number being used on the network • that all the devices on the same DH-485 network have the same selection for the maximum node address.

Planning a DH-485 Network

The DH-485 network offers:

- interconnection of 32 devices
- multi-master capability
- token passing access control
- the ability to add or remove nodes without disrupting the network
- maximum network length of 1219 m (4000 ft.)

The DH-485 protocol supports two classes of devices: initiators and responders. All initiators on the network get a chance to initiate message transfers. The DH-485 protocol uses a token-pass algorithm to determine which initiator has the right to transmit.

DH-485 Token Rotation

A node holding the token can send any valid packet onto the network. As a default, each node gets only one transmission (plus two retries) each time it receives the token. After a node sends one message packet, it attempts to give the token to its successor by sending a “token pass” packet to its successor.

If no network activity occurs, the initiator sends the token pass packet again. After two retries (a total of three tries) the initiator attempts to find a new successor.

IMPORTANT The maximum address that the initiator searches for before starting again with zero is the value in the configurable parameter “maximum node address.” The default and maximum value for this parameter is 31 for all initiators and responders.

The allowable range of the node address of a initiator is 0 to 31. The allowable address range for all responders is 1 to 31. There must be at least one initiator on the network.

Network initialization

The network requires at least one initiator to initialize it. Network initialization begins when a initiator on the network detects a period of inactivity that exceeds the time of a link dead timeout. When the link dead timeout is exceeded, usually the initiator with the lowest address claims the token. When a initiator has the token it will begin to build the network.

Building a network begins when the initiator that claimed the token tries to pass the token to the successor node. If the attempt to pass the token fails, or if the initiator has no established successor (for example, when it powers up), it begins a linear search for a successor starting with the node above it in the addressing.

When the initiator finds another active node, it passes the token to that node, which repeats the process until the token is passed all the way around the network to the initial node. At this point, the network is in a state of normal operation.

Number of Nodes and Node Addresses

The number of nodes on the network directly affects the data transfer time between nodes. Unnecessary nodes (such as a second programming terminal that is not being used) slow the data transfer rate. The maximum number of nodes on the network is 32.

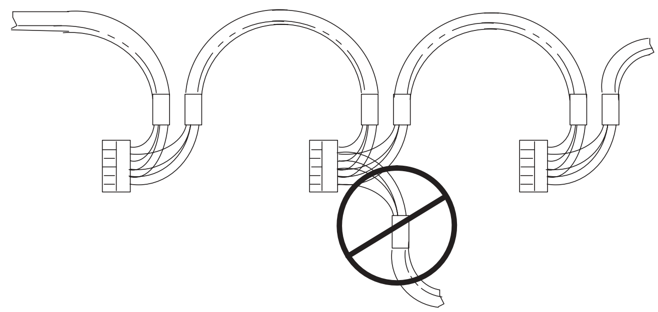
If the node addresses for controllers are assigned in sequence, starting at node 1 (with node 0 left for a programming terminal), it is as efficient to leave the maximum node address at 31 as it is to decrease it to the highest node address on the network. Then, adding devices to the network at a later time will not require modifying the maximum node address in every device on the network. The maximum node address should be the same for all devices on a DH-485 network for optimal operation.

The best network performance occurs when node addresses start at 0 and are assigned in sequential order. The controller defaults to node address 1. Initiators, such as personal computers, should be assigned the lowest numbered addresses to minimize the time required to initialize the network.

Installing a DH-485 Network

A DH-485 network consists of a number of cable segments daisy-chained together. The total length of the cable segments cannot exceed 1219 m (4000 ft).

IMPORTANT Use shielded, twisted-pair cable, either Belden 3106A or Belden 9842. A daisy-chained network is recommended.



When cutting cable segments, make them long enough to route them from one link coupler to the next with sufficient slack to prevent strain on the connector. Allow enough extra cable to prevent chafing and kinking in the cable.

Figure 7.2 Single cable connection

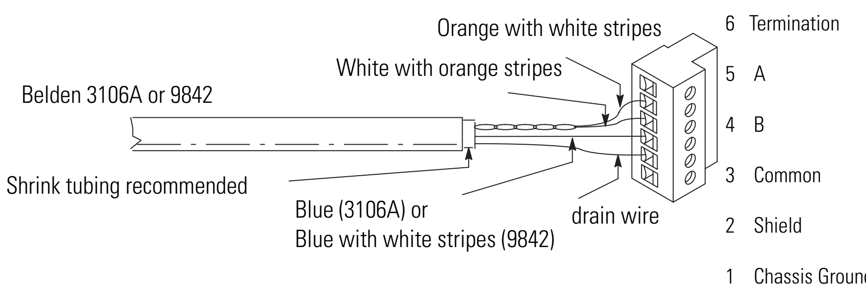


Figure 7.3 Multiple cable connection

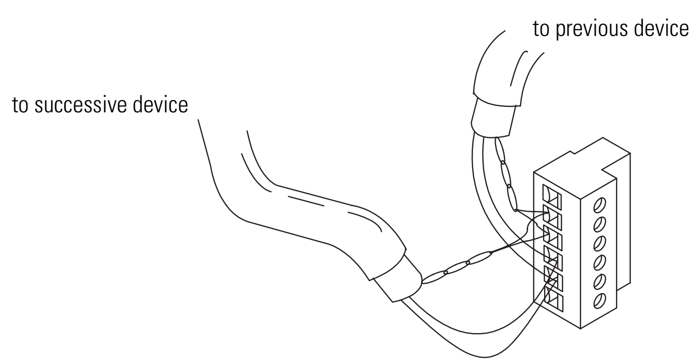


Table 7.4 shows wire/terminal connections for Belden 3106A.

Table 7.4

For this Wire/Pair	Connect this Wire	To this Terminal
shield/drain	non-jacketed	2 - Shield
blue	blue	3 - (Common)
white/orange	white with orange stripe	4 - (Data B)
	orange with white stripe	5 - (Data A)

Table 7.5 shows wire/terminal connections for Belden 9842.

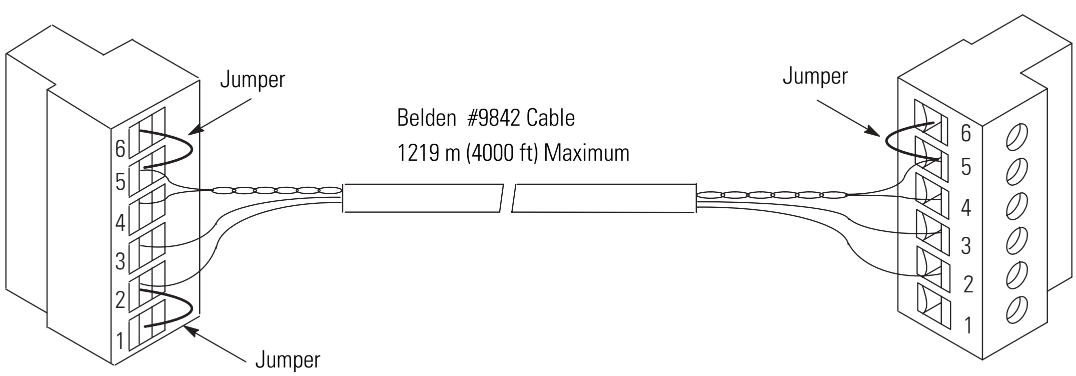
Table 7.5

For this Wire/Pair	Connect this Wire	To this Terminal
shield/drain	non-jacketed	2 - Shield
blue/white	white with blue stripe	cut back - no connection(1)
	blue with white stripe	3 - (Common)
white/orange	white with orange stripe	4 - (Data B)
	orange with white stripe	5 - (Data A)

(1) To prevent confusion when installing the communication cable, cut back the white with blue stripe wire immediately after the insulation jacket is removed. This wire is not used by DH-485.

Grounding and terminating a DH-485 network

Figure 7.4

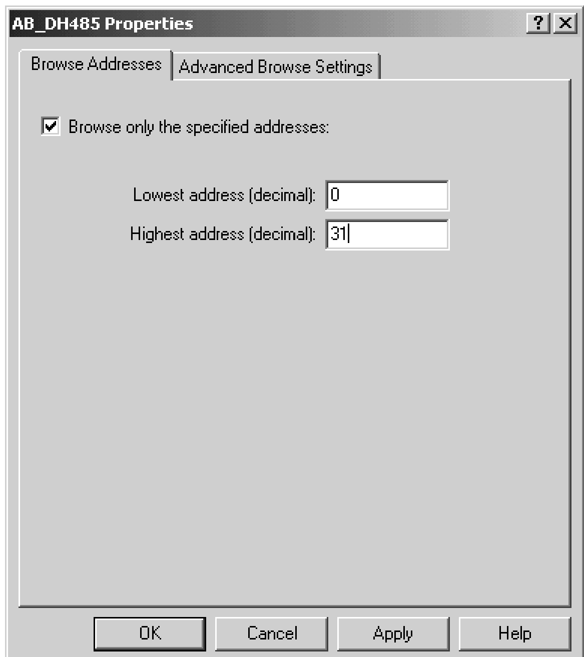


Browsing a DH-485 Network Remotely

To improve performance when browsing a DH-485 network, configure the DH-485 network properties in RSLinx software to display only those nodes that actually exist on the network.

1. In RSLinx software, right-click on the DH-485 network you plan to browse and select Properties.

2. On the Browse Addresses tab, specify the lowest and highest addresses that exist on the DH-485 network.



If you do not specify a specific range of addresses on the DH-485 network, the RSWho function in RSLinx software attempts to locate a device at every node address. Trying to locate devices that do not exist adds considerable time to displaying the RSWho window for the nework.

CompactLogix System Specifications

Using This Appendix

Table A.1

1769-L35CR Controller Specifications

Table A.2 lists the 1769-L35CR specifications.

Table A.2

Communication Ports	**CH0 – RS-232** RS-232 **ControlNet** NAP ControlNet channels A and B
User Memory	1.5 Mbytes
Nonvolatile Memory	1784-CF64 CompactFlash
Maximum Number of I/O Modules	30 I/O modules
Maximum Number of I/O Banks	3 banks
Backplane Current(1)	680mA at 5V dc 40mA at 24V dc
Power Dissipation	4.36W
Power Supply Distance Rating	4 (The controller must be within four slot positions of the power supply.)
Replacement Battery	1769-BA - For information on typical battery life, see page B-9.
Weight	0.32 kg (0.70 lb.)
Programming Cable	1747-CP3 or 1756-CP3
Panel Mounting Screw Torque (using M4 or #8 screws)	10 - 16 in-lb (1.1 - 1.8 Nm)
Wiring	
Connectors	2 BNC connectors for redundant media operation 1 NAP (1786-CP cable)
Category	2 on communication ports(3)
Isolation Voltage (continuous-voltage withstand rating)	30Vdc Tested to withstand 710 Volts for 60 seconds
Environmental Conditions	
Operational Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): -40 to 85°C (-40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC 60068-2-6 (Test Fc, Operating): 5g @ 10-500Hz

Table A.2

Operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): DIN mount - Operating: 20G, Panel mount - Operating: 30G
Non-Operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): DIN mount - Non-operating: 30G, Panel mount - Non-operating: 40G
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 4kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 80MHz to 2000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz 10V/m with 200Hz 50% Pulse 100%AM at 1890Mhz
EFT/B Immunity	IEC 61000-4-4: +/-2kV at 5kHz on communications ports
Surge Transient Immunity	IEC 61000-4-5: +/-2kV line-earth(CM) on communications ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications:[2] (when product is marked)	c-UL-us UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada CE European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions CI ControlNet Int'l conformance tested to ControlNet specifications

(1) This specification is also known as Power Consumption.

(2) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

(3) Use this Conductor Category information for planning conductor routing. Refer to Publication 1770-4.1, "Industrial Automation Wiring and Grounding Guidelines".

1769-L32E, 1769-L35E Controller Specifications

Table A.3 lists the 1769-L32E and 1769-L35E specifications.

Table A.3

Description	1769-L32E	1769-L35E
Communication Ports	**CH0 - RS-232** RS-232 DF1 38.4 Kbit/s maximum	**EtherNet/IP** RJ-45 or 10BaseT EtherNet/IP 10/100 MBytes/sec
User Memory	750 Kbytes	1.5 Mbytes
Nonvolatile Memory	1784-CF64 CompactFlash	
Maximum Number of I/O Modules	16 I/O modules	30 I/O modules
Maximum Number of I/O Banks	3 banks	3 banks
Backplane Current	660 mA at 5V dc 90 mA at 24V dc	660 mA at 5V dc 90 mA at 24V dc
Power Dissipation	4.74 W	4.74 W
Power Supply Distance Rating	4 (The controller must be within four slot positions of the power supply.)	
Battery	1769-BA	
Weight	0.32 kg (0.70 lb.)	0.32 kg (0.70 lb.)
Programming Cable	1747-CP3 or 1756-CP3	
Panel Mounting Screw Torque (using M4 or #8 screws)	10 - 16 in-lb (1.1 - 1.8 Nm)	
Enclosure Type Rating	none (open style)	
Wiring Category	2 on communication ports(2)	
Isolation Voltage (continuous-voltage withstand rating)	30V dc continuous Tested to withstand 710V dc for 60 sec	
Environmental Conditions		
Operational Temperature	IEC 60068-2-1 (Test Ad, Operating Cold) IEC 60068-2-2 (Test Bd, Operating Dry Heat) IEC 60068-2-14 (Test Nb, Operating Thermal Shock) 0° to +60°C (+32° to +140°F)	
Storage Temperature	IEC 60068-2-1 (Test Ab, Unpackaged Non-operating Cold) IEC 60068-2-2 (Test Bb, Unpackaged Non-operating Dry Heat) IEC 60068-2-14 (Test Na, Unpackaged Non-operating Thermal Shock) -40° to +85°C (-40° to +185°F)	
Relative Humidity	IEC 60068-2-30 (Test Db, Unpackaged Non-operating Damp Heat) 5% to 95% non-condensing	
Vibration	IEC 60068-2-6 (Test Fc, Operating) 5G @ 10-500Hz	

Table A.3

Description	**1769-L32E**	**1769-L35E**
Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock) DIN mount – Operating: 20G; Non-operating: 30G Panel mount – Operating: 30G; Non-operating: 40G	
Emissions	CISPR 11: Group 1, Class A	
ESD Immunity	IEC 61000-4-2: 4kV contact discharges 8kV air discharges	
Radiated RF Immunity	IEC61000-4-3 10V/M with 1kHz sine-wave 80%AM from 80MHz to 2000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900MHz 10V/m with 200Hz 50% Pulse 100%AM at 1890MHz	
EFT/B Immunity	IEC 61000-4-4 ±2kV at 5kHz on communication ports	
Surge Transient Immunity	IEC61000-4-5 ±2kV line-earth (CM) on shielded ports	
Conducted RF Immunity	IEC61000-4-6 10Vrms with 1kHz sine-wave 80% AM from 150kHz to 80MHz	
Certifications[1] (when product is marked):	c-UL-us UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada CE European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick Australian Radio Communications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions	

(1) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

(2) Use this Conductor Category information for planning conductor routing. See *Industrial Automation Wiring and Grounding Guidelines*, publication 1770-4.1.

1769-L31 Controller Specifications

Table A.4 lists the 1769-L31 specifications.

Table A.4

Communication Ports	**CH0 - RS-232** RS-232 DF1, DH-485, ASCII fully isolated 38.4 Kbit/s maximum	**CH1 - RS-232** RS-232 DF1, DH-485 non-isolated 38.4 Kbit/s maximum
User Memory	512 Kbytes	
Nonvolatile Memory	1784-CF64 CompactFlash	
Maximum Number of I/O Modules	16 I/O modules	
Maximum Number of I/O Banks	3 banks	
Backplane Current	330 mA at 5V dc 40 mA at 24V dc	
Power Dissipation	2.61 W	
Power Supply Distance Rating	4 (The controller must be within four slot positions of the power supply.)	
Battery	1769-BA	
Weight	0.30 kg (0.66 lb.)	
Programming Cable	1747-CP3 or 1756-CP3	
Panel Mounting Screw Torque (using M4 or #8 screws)	10 - 16 in-lb (1.1 - 1.8 Nm)	
Enclosure Type Rating	none (open style)	
Wiring Category	2 on communication ports[(2)]	
Isolation Voltage (continuous-voltage withstand rating)	30V dc continuous Tested to withstand 710V dc for 60 sec	
Environmental Conditions		
Operational Temperature	IEC 60068-2-1 (Test Ad, Operating Cold) IEC 60068-2-2 (Test Bd, Operating Dry Heat) IEC 60068-2-14 (Test Nb, Operating Thermal Shock) 0° to +60°C (+32° to +140°F)	
Storage Temperature	IEC 60068-2-1 (Test Ab, Unpackaged Non-operating Cold) IEC 60068-2-2 (Test Bb, Unpackaged Non-operating Dry Heat) IEC 60068-2-14 (Test Na, Unpackaged Non-operating Thermal Shock) -40° to +85°C (-40° to +185°F)	
Relative Humidity	IEC 60068-2-30 (Test Db, Unpackaged Non-operating Damp Heat) 5% to 95% non-condensing	
Vibration	IEC 60068-2-6 (Test Fc, Operating) 5G @ 10-500Hz	

Table A.4

Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock) DIN mount – Operating: 20G; Non-operating: 30G Panel mount – Operating: 30G; Non-operating: 40G
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 4kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC61000-4-3 10V/M with 1kHz sine-wave 80%AM from 80MHz to 2000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900MHz 10V/m with 200Hz 50% Pulse 100%AM at 1890MHz
EFT/B Immunity	IEC 61000-4-4 ±2kV at 5kHz on communication ports
Surge Transient Immunity	IEC61000-4-5 Channel 0: ±2kV line-earth (CM) on shielded ports Channel 1: ±1kV line-earth (CM) on shielded ports
Conducted RF Immunity	IEC61000-4-6 10Vrms with 1kHz sine-wave 80% AM from 150kHz to 80MHz
Certifications[1] (when product is marked):	c-UL-us UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada CE European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick Australian Radio Communications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions

(1) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

(2) Use this Conductor Category information for planning conductor routing. See *Industrial Automation Wiring and Grounding Guidelines*, publication 1770-4.1.

Real-Time Clock Accuracy

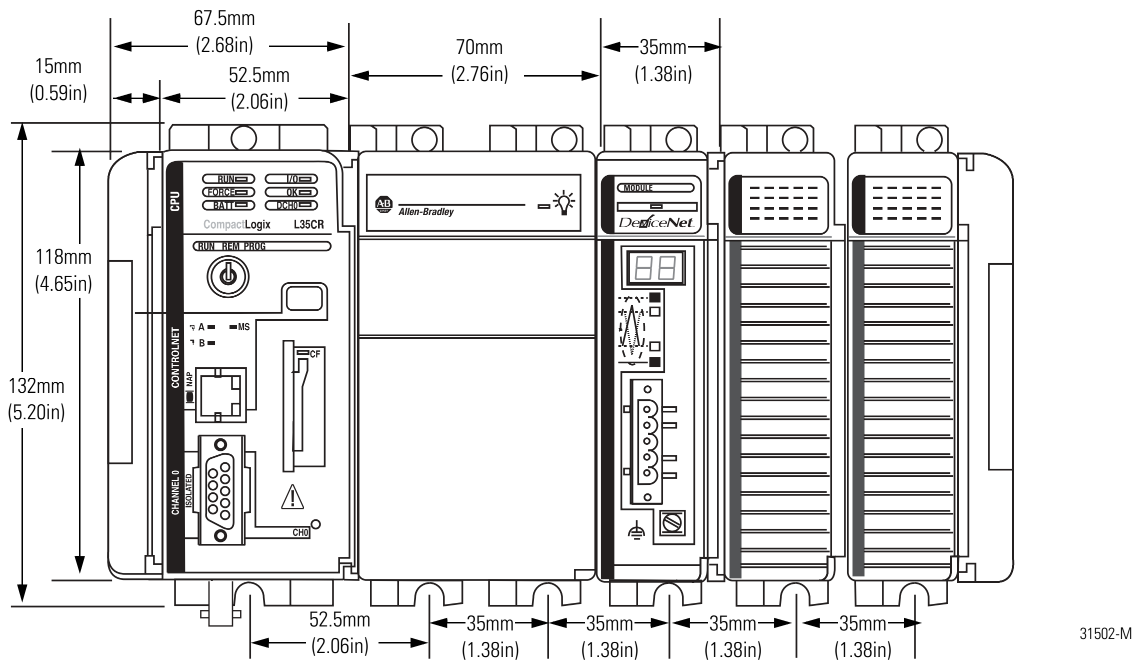
Table A.5

Ambient ° C:	Accuracy:
0° C	+54 to -56 seconds/month
+25° C	+9 to -124 seconds/month
+40° C	-84 to -234 seconds/month
+55° C	-228 to -394 seconds/month
+60° C	-287 to -459 seconds/month

Dimensions

1769-L35CR controller

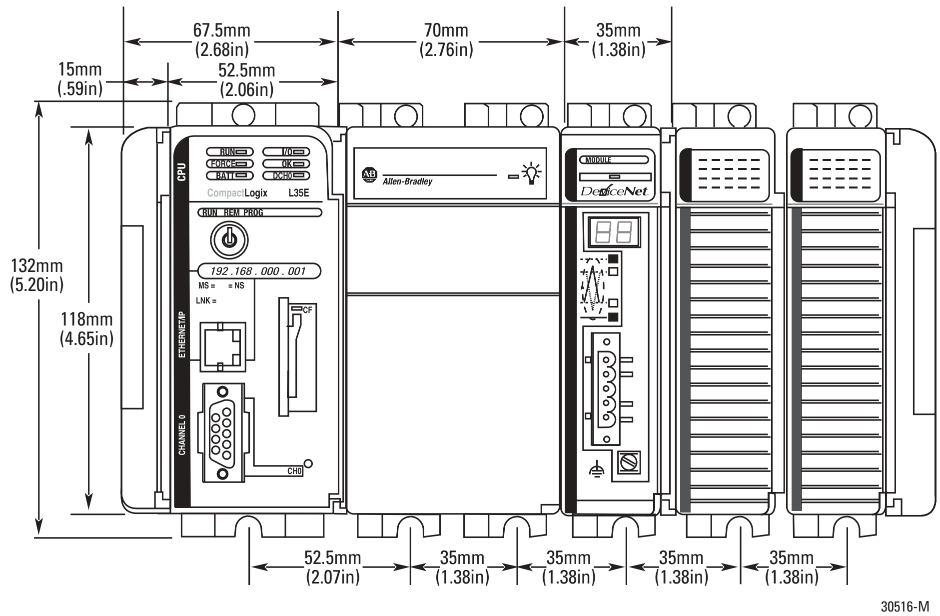
Figure A.1



NOTE: All dimensions are in mm (in.).
Hole spacing tolerance: ±0.4 mm (0.016 in.)

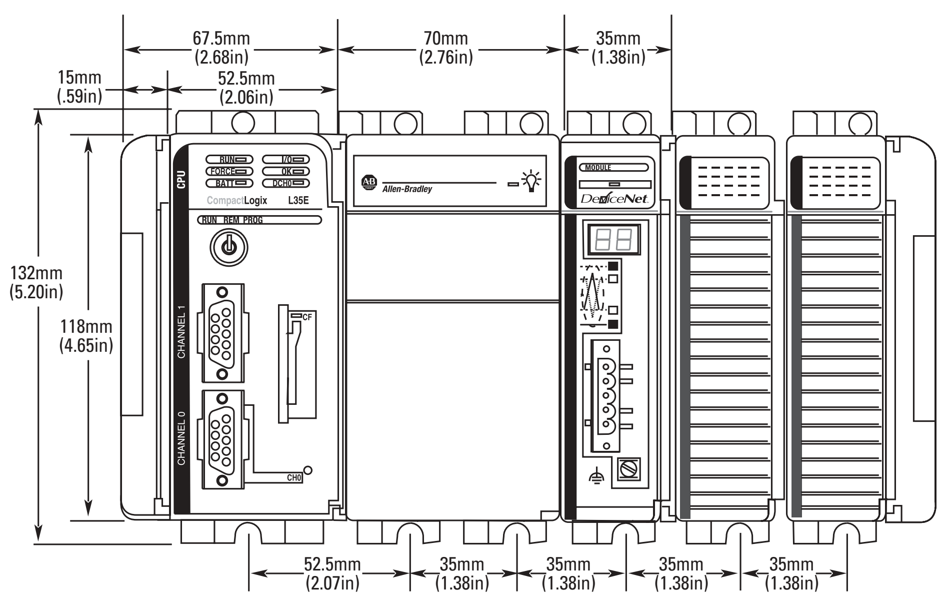
1769-L32E, 1769-L35E controller

Figure A.2



1769-L31 controller

Figure A.3



Notes:

CompactLogix System Status Indicators

Using This Appendix

Use this appendix to interpret the status indicators on your CompactLogix controllers.

Table B.1

Controller LEDs

Table B.2 describes the controller LEDs present on all CompactLogix controllers.

Table B.2

If this indicator:	is in this condition:	It means:
RUN	off	The controller is in Program or Test mode.
	steady green	The controller is in Run mode.
FORCE	off	No tags contain I/O force values. I/O forces are inactive (disabled).
	steady amber	I/O forces are active (enabled). I/O force values may or may not exist.
	flashing amber	One or more input or output addresses have been forced to an On or Off state, but the forces have not been enabled.
BAT	off	The battery supports memory.
	steady red	Either the battery is: • not installed. • 95% discharged and should be replaced.
I/O	off	Either: • There are *no* devices in the I/O configuration of the controller. • The controller does *not* contain a project (controller memory is empty).
	steady green	The controller is communicating with all the devices in its I/O configuration.
	flashing green	One or more devices in the I/O configuration of the controller are *not* responding.
	flashing red	The controller is not communicating to any devices. The controller is faulted.

Table B.2

<table>
<tr><th>If this indicator:</th><th>is in this condition:</th><th>It means:</th></tr>
<tr><td>OK</td><td>off</td><td>No power is applied.</td></tr>
<tr><td></td><td>flashing red</td><td>One of the following:
• The controller requires a firmware update.

• A major fault occurred on the controller. To clear the fault:
1. Turn the controller keyswitch from PROG to RUN to PROG.
2. Go online with RSLogix 5000.

• A non-recoverable fault occurred on the controller. In this case, the controller:
1. initially displays a steady red LED,
2. clears the project from its memory,
3. recovers itself,
4. sets the LED to flashing red,
5. produces a major fault,
6. and generates a fault code in the RSLogix 5000 project.
The fault code displayed in RSLogix 5000, and the subsequent fault recovery method, depends on whether you have installed a CompactFlash card in the controller.
<table>
<tr><th>Code:</th><th>Means:</th><th>Fault recovery method:</th></tr>
<tr><td>60</td><td>CompactFlash card is not installed</td><td>A. Clear the fault.
B. Download the project.
C. Change to Remote Run/Run mode.
If the problem persists:
A. Before you cycle power to the controller, record the state of the OK and RS232 LED indicators.
B. Contact Rockwell Automation support. See the back of this publication.</td></tr>
<tr><td>61</td><td>CompactFlash is installed</td><td>1. Clear the fault.
2. Download the project.
3. Change to Remote Run/Run mode.
If the problem persists, contact Rockwell Automation support. See the back of this publication.</td></tr>
</table>
</td></tr>
<tr><td></td><td>steady red - only appears if the CompactLogix controller in an RSLogix 5000 project, version 12 or earlier</td><td>The controller detected a non-recoverable fault, so it cleared the project from memory. To recover:
1. Cycle power to the chassis.
2. Download the project.
3. Change to Run mode.
If the OK LED remains steady red, contact your Rockwell Automation representative or local distributor.</td></tr>
<tr><td></td><td>steady green</td><td>Controller is OK.</td></tr>
<tr><td></td><td>flashing green</td><td>The controller is storing or loading a project to or from nonvolatile memory.</td></tr>
</table>

CompactFlash card LED

ATTENTION

Do not remove the CompactFlash card while the controller is reading from or writing to the card, as indicated by a flashing green CF LED. This could corrupt the data on the card or in the controller, as well as corrupt the latest firmware in the controller.

Table B.3 describes the CompactFlash card LEDs present on all CompactLogix controllers.

Table B.3

If this indicator:	is in this condition:	It means:
CF	off	No activity.
	flashing green	The controller is reading from or writing to the CompactFlash card.
	flashing red	CompactFlash card does not have a valid file system.

RS-232 Serial Port LEDs

Table B.4 describes the RS-232 serial port LEDs present on all CompactLogix controllers.

Table B.4

If this indicator:	is in this condition:	It means:
DCH0	off	Channel 0 is configured differently than the default serial configuration.
	steady green	Channel 0 has the default serial configuration.
CH0	off	No RS-232 activity.
	flashing green	RS-232 activity.
CH1 (1769-L31 only)	off	No RS-232 activity.
	flashing green	RS-232 activity.

ControlNet LEDs

The ControlNet LEDs are only on the 1769-L35CR controller.

Interpret Status Indicators as Related to the ControlNet Network

Use the following status indicators to determine how your CompactLogix 1769-L35CR controller is operating on the ControlNet network:

- Module Status
- Network Status

These status indicators provide information about the controller and the network when the controller is connected to ControlNet via the BNC connectors. Table B.5 describes the possible conditions for module and network status indicators.

Table B.5

If an indicator is described in this condition:	It means:
steady	The indicator is on continuously in the defined state.
alternating	Two indicators alternate between the two defined states at the same time (applies to both indicators when *viewed together*); the two indicators are always in opposite states, out of phase.
flashing	The indicator alternates between the two defined states (applies to each indicator viewed independent of the other); if both indicators are flashing, they flash together, in phase.

IMPORTANT Keep in mind that the Module Status indictor reflects the module state (e.g., self-test, firmware update, normal operation but no connection established). The network status indicators, A and B, reflect network status. Remember that the host is able to engage in local messaging with the card although it is detached from the network. Therefore, the Module Status LED is flashing green if the host has successfully started the card. Note, however, that until the host removes reset, all communication port LEDs.

When you view the indicators, always view the Module Status indicator first to determine the state of the communication port. This information may help you to interpret the network status indicators. As a general practice, view all status indicators (Module Status and Network Status) together to gain a full understanding of the daughtercard's status.

Module Status (MS) indicator

Table B.6

If the MS indicator is in this condition:	It means:	Take this action:
off	the controller has no power.	Apply power.
	the controller is faulted.	Make sure that the controller is firmly seated in the slot.
steady red	a major fault has occurred on the controller.	1. Cycle power. 2. If the problem persists, replace the controller.
flashing red	a minor fault has occurred because a firmware update is in progress.	No action required (firmware update in progress.)
	a node address switch change has occurred. The controller's node address switches may have been changed since power-up.	Change the node address switches back to the original setting. The module will continue to operate properly.
	the controller uses invalid firmware.	Update the controller firmware with the ControlFlash Update utility.
	the controller's node address duplicates that of another device.	1. Remove power. 2. Change the node address to a unique setting. 3. Reapply power.
steady green	connections are established.	None
flashing green	no connections are established.	Establish connections, if necessary.
flashing red/green	the controller is performing self-diagnostics.	Wait briefly to see if problem corrects itself If problem persists, check the host. If the daughtercard cannot communicate with the host, the card may remain in self-test mode.

Network Channel Status indicators

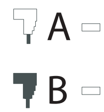


Table B.7

If both channel status indicators are in this condition:	**It means:**	**Take this action:**
off	a channel is disabled.	Program network for redundant media, if necessary.
steady green	normal operation is occurring.	None
flashing green/off	temporary network errors have occurred.	1. Check media for broken cables, loose connectors, missing terminators, etc. 2. If condition persists, refer to the ControlNet Planning and Installation Manual, publication 1786-6.2.1.
	the node is not configured to go online.	Make sure the network keeper is present and working and the selected address is less or equal to the UMAX[1].
flashing red/off	media fault has occurred.	1. Check media for broken cables, loose connectors, missing terminators, etc. 2. If condition persists, refer to the ControlNet Planning and Installation Manual, publication 1786-6.2.1.
	no other nodes present on the network.	Add other nodes to the network.
flashing red/green	the network is configured incorrectly.	Reconfigure the ControlNet network so that UMAX is greater than or equal to the card's node address.
If either channel status indicators are in this condition::	**It means:**	**Take this action:**
off	you should check the MS indicators.	Check the MS indicators.
steady red	the controller is faulted.	1. Cycle power. 2. If the fault persists, contact your Rockwell Automation representative or distributor.
alternating red/green	the controller is performing a self-test.	None
alternating red/off	the node is configured incorrectly.	Check the card's network address and other ControlNet configuration parameters.

(1) UMAX is the highest node address on a ControlNet network that can transmit data.

EtherNet/IP LEDs

The EtherNet/IP LEDS are only on 1769-L32E and 1769-L35E controllers.

Module Status (MS) indicator

Table B.8

If the MS indicator is in this condition:	It means:	Take this action:
off	The controller does not have power.	Check the controller power supply.
flashing green	The port is in standby mode; it does not have an IP address and is operating in BOOTP mode.	Verify that the BOOTP server is running.
steady green	The port is operating correctly.	Normal operation. No action required.
steady red	The controller is holding the port in reset or the controller is faulted.	1. Clear the controller fault. 2. If the fault will not clear, replace the controller.
	The port is performing its power-up self-test.	Normal operation during power-up. No action required.
	An unrecoverable fault has occurred.	1. Cycle power to the controller. 2. If the fault will not clear, replace the controller.
flashing red	The port firmware is being updated.	Normal operation during firmware update. No action required.

Network Status (NS) indicator

Table B.9

If the NS indicator is in this condition:	It means::	Take this action:
off	The port is not initialized; it does not have an IP address and is operating in BOOTP mode.	Verify that the BOOTP server is running.
flashing green	The port has an IP address, but no CIP connections are established.	Normal operation if no connections are configured. No action required. If connections are configured, check connection originator for connection error code.
steady green	The port has an IP address and CIP connections (Class 1 or Class 3) are established.	Normal operation. No action required.
steady red	The port has detected that the assigned IP address is already in use.	Verify that all IP addresses are unique.
flashing red/green	The port is performing its power-up self-test.	Normal operation during powerup.

Link Status (LNK) indicator

Table B.10

If the LNK indicator is in this condition:	It means:	Take this action:
off	The port is not connected to a powered Ethernet device. Therefore, the port cannot communicate on Ethernet.	1. Verify that all Ethernet cables are connected. 2. Verify that Ethernet switch is powered.
flashing green	The port is performing its power-up self-test.	Normal operation during powerup.
	The port is communicating on Ethernet.	Normal operation. No action required.
steady green	The port is connected to a powered Ethernet device. Therefore, the port can communicate on Ethernet.	Normal operation. No action required.

Battery Life

Table B.11 describes typical battery life in certain conditions.

Table B.11

Time ON/OFF	at 25° C (77° F)	at 40° C (104° F)	at 60° C (140° F)
Always OFF	14 months	12 months	9 months
ON 8 hours per day 5 days per week	18 months	15 months	12 months
ON 16 hours per day 5 days per week	26 months	22 months	16 months
Always ON	There is almost no drain on the battery when the controller is always ON.		

Battery duration after the LED turns ON

The battery indicator (BAT) warns you when the battery is low. These durations are the amounts of time the battery will retain controller memory from the time the controller is powered down after the LED first turns on.

Table B.12

Temperature	Duration
60° C	8 days
25° C	25 days

Notes:

EtherNet/IP Diagnostics

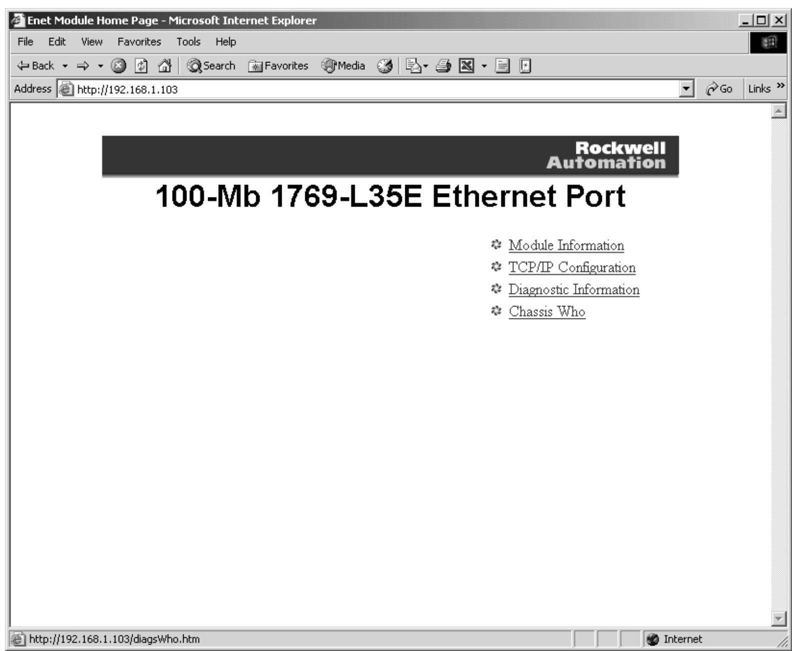
Using This Appendix

The 1769-L32E and 1769-L35E controllers support web-based diagnostics.

Table C.1

For information about:	See page
Module information	C-2
TCP/IP configuration	C-2
Diagnostic information	C-3

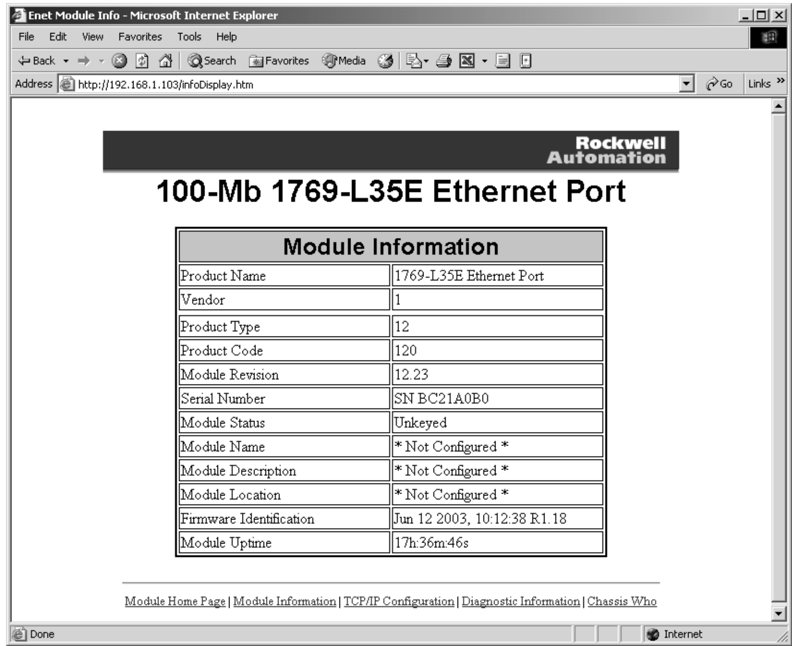
The EtherNet/IP controllers support web-based diagnostic pages that offer both internal and network diagnostics. To view the main web page, type the controller's IP address in your browser's address field.



From the main page, select links to display specific diagnostic information.

Module Information

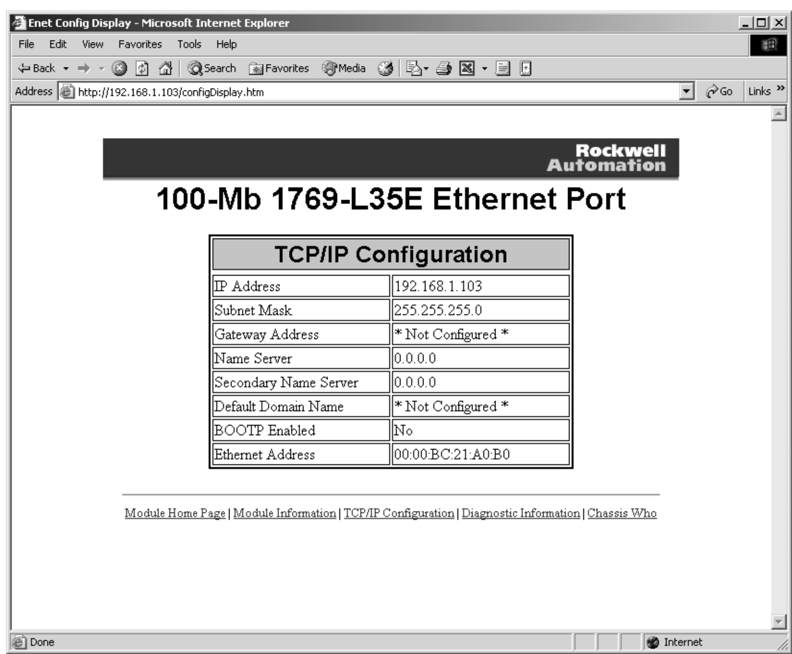
Use the Module Information to display identification information about the controller.



Module Information	
Product Name	1769-L35E Ethernet Port
Vendor	1
Product Type	12
Product Code	120
Module Revision	12.23
Serial Number	SN BC21A0B0
Module Status	Unkeyed
Module Name	* Not Configured *
Module Description	* Not Configured *
Module Location	* Not Configured *
Firmware Identification	Jun 12 2003, 10:12:38 R1.18
Module Uptime	17h:36m:46s

TCP/IP Configuration

Use the TCP/IP Configuration page to display the current TCP/IP configuration settings for the controller.

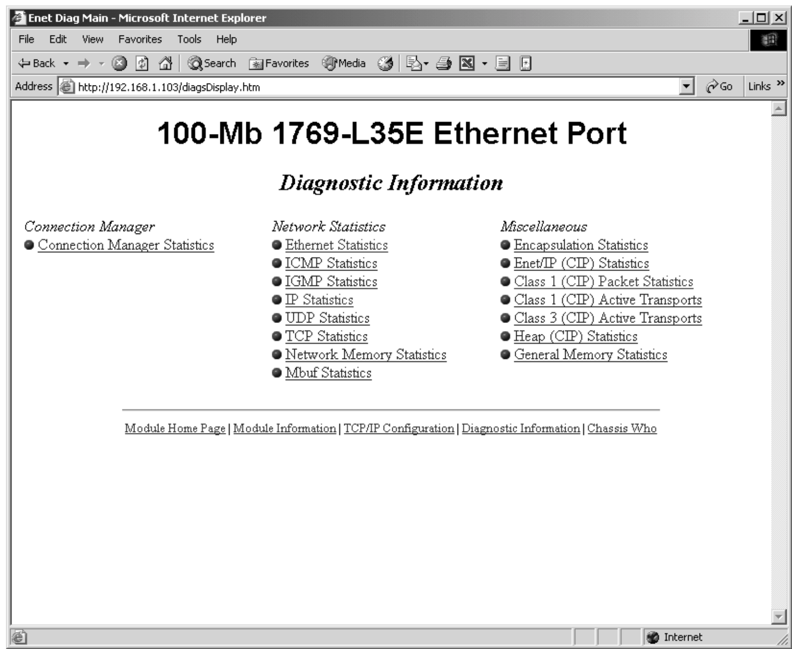


TCP/IP Configuration	
IP Address	192.168.1.103
Subnet Mask	255.255.255.0
Gateway Address	* Not Configured *
Name Server	0.0.0.0
Secondary Name Server	0.0.0.0
Default Domain Name	* Not Configured *
BOOTP Enabled	No
Ethernet Address	00:00:BC:21:A0:B0

Diagnostic Information

Use the Diagnostic Information page to display diagnostic information about:

- Class 1 connections - The most time critical connections, including I/O and produce/consume connections.
- Class 3 connections - The less time critical connections, such as those used for MMI and PLC programming or PLC to PLC messaging.



In the Miscellaneous section, you can get access to:

- Encapsulation statistics - General information about TCP connections, such as active incoming or outgoing connections and the total limit of TCP connections that can be made to the device.
- Class 1 (CIP) packet statistics - Information about the speed, duplex and user datagram (UDP) packet rates of CIP connections.
- Class 1 (CIP) transports - Specific information about any Class 1 (CIP) connections made to the device.
- Class 3 (CIP) transports - Specific information about any Class 3 (CIP) connections made to the device.

Encapsulation statistics

The Encapsulation Statistics offer general information about TCP connections coming into and going out of the device.

Table C.2

Field:	Definition:
Cumulative Encap (TCP) Connections	The total number of incoming and outgoing TCP module connections since powering up.
Active Total Encap (TCP) Connections	The number of incoming and outgoing TCP module connections currently active.
Total Encap (TCP) Connection Limit	The maximum number (64) of incoming or outgoing TCP connections the module can make at any single moment in time.
Active Incoming Encap (TCP) Connections	The number of TCP module connections coming in from the Ethernet media currently active.
Incoming Encap (TCP) Connection Limit	The maximum number (64) of incoming TCP connections the module can make at any single moment in time.
Active Outgoing Encap (TCP) Connections	The number of TCP module connections going out to the Ethernet media currently active.
Outgoing Encap (TCP) Connection Limit	The maximum number (64) of outgoing TCP connections the module can make at any single moment in time.

Class 1 (CIP) packet statistics

The Class 1 (CIP) Packet Statistics offer information about the speed, duplex and user datagram protocol (UDP) frame rate of TCP connections coming into and going out of the device.

Table C.3

Field:	Definition:
Link Status	Denotes whether the current link is active or inactive.
Speed	The speed that the module is passing data over the Ethernet network.
Mode	The module's communication mode, full-duplex or half-duplex.
Total Packet Capacity	Total number of Class 1 UDP packets your module can handle over the Ethernet network at any time.
Total Class 1 Packets/Second	Number of Class 1 UDP packets your module is currently receiving or transmitting over the Ethernet network.
Actual Reserved Class 1 Capacity	Number of Class 1 UDP packets your module can receive or transmit over the Ethernet network.

Class 1 (CIP) transports

The Class 1 (CIP) Transports offer specific information about Class 1 (CIP) connections coming into and going out of the device.

Table C.4

Field:	Definition:
Type	Type of connection. This field can be either consumer or producer.
Trigger	The mechanism by which the producer produces new data. The mechanism can be Cyclic, Change-of-State, or Application triggered
State	The state of the connection, either active or inactive.
Remote Address	The remote IP address of the connection's originator or destination.
Bridged	Denotes whether the connection is bridged across the controller or not.

Class 3 (CIP) transports

The Class 3 (CIP) Transports screen offers general information about TCP connections coming into and going out of the device

Table C.5

Field:	Definition:
Type	Type of connection. This field can be either consumer or producer. However, for class 3, this will be Client or Server.
State	The state of the connection, either active or inactive.
Remote Address	The IP address of the originator or destination.
Bridged	Denotes whether the connection is bridged across the controller or not.

Notes:

Dynamic Memory Allocation in CompactLogix Controllers

Certain operations cause the controller to dynamically allocate and de-allocate user-available memory, affecting the space available for program logic. As these functions become active, memory is allocated. Memory is then de-allocated when these functions become inactive.

Operations that dynamically allocate memory are:

- Messages
- Connection to a Processor with RSLogix 5000
- RSLinx Tag Optimization
- Trends
- DDE/OPC Topics

Although messages are the most likely to cause dynamic memory allocation on a CompactLogix system, all the above operations are discussed in the following sections, along with general guidelines for estimating the amount of memory allocated.

Messages

Messages can come in and go out of the controller via the Ethernet port or the serial port, causing memory allocation as described in the table below. The memory allocations for messages destined to I/O are accounted for in these allocations. One simple method to reduce the effect that message instructions have on user-available memory is to prevent messages from being sent simultaneously. In general, interlocking messages in this fashion is good practice for peer-to-peer communications.

Table D.1

Type		Connection Established	Dynamic Memory Allocated
ControlNet Port	Incoming	The message is connected (connection established)	1200 bytes
		The message is unconnected (no connection established)	1200 bytes
	Outgoing	All outgoing messages whether connected or unconnnected	1200 bytes
Ethernet Port	Incoming	The message is connected (connection established)	1200 bytes
		The message is unconnected (no connection established)	1200 bytes
	Outgoing	All outgoing messages whether connected or unconnnected	1200 bytes
Serial Port	Incoming	All incoming messages whether connected or unconnected	1200 bytes
	Outgoing	All outgoing messages whether connected or unconnected	1200 bytes

RSLinx Tag Optimization

Tag optimization creates three items which allocate memory, a trend object, a trend driver, and a connection.

Table D.2

Item	Description	Memory Allocated
Trend Object	Created in the controller to group the requested tags. One trend object can handle approximately 100 tags (connection points)	80 bytes
Trend Driver	Created to communicate to the trend object	36 bytes/single point (some economy for multiple points in a driver)
Connection	Created between the controller and RSLinx	1200 bytes

EXAMPLE

To monitor 100 points:

100 points x 36 bytes = 3600 bytes (Trend Driver)

3600 (Trend Driver) + 80 (Trend Object) + 1200 (Connection)

= approximately 4000 bytes[1]

(1) In general, we estimate that one tag takes about 40 bytes of memory.

Trends

Each trend created in a controller creates a trend object and allocates a buffer for logging as shown below.

Table D.3

Item	Memory Allocated
Trend Object	80 bytes
Log Buffer	4000 bytes

DDE/OPC Topics

A DDE/OPC Topic uses connections based on the following three variables:

- the number of “Maximum Messaging Connections per PLC” configured in RSLinx
- whether the “Use Connections for Writes to ControlLogix processor” is checked
- the number of connections needed to optimize throughput

IMPORTANT These variables are per path. For example, if you set up two different DDE/OPC topics, with different paths to the same controller, the variables limit the connections for each path. Therefore, if you have a limit of 5 connections, it is possible to have 10 connections, with 5 over each path.

Maximum Messaging Connections per PLC

This variable is configured in RSLinx under the “Communications” menu item “Configure CIP Options”. This number limits the number of read connections made to Logix controllers from a particular workstation.

Checking “Use Connections for Writes to ControlLogix Controller”

This variable is configured in RSLinx under the “Communications” menu item “Configure CIP Options”. This check box indicates whether you want RSLinx to open up additional connections for writing data to a Logix controller.

TIP There is no way to limit the number of write connections, once this box is checked.

Number of Connections Needed to Optimize Throughput

RSLinx only opens the number of connections required to optimize throughput. For example, if you have 1 tag on scan, but have configured RSLinx to allow five connections as the maximum number of connections, RSLinx only opens one connection for the tag. Conversely, if you have thousands of tags on scan and limit the maximum number of CIP connections to five, that is the maximum number of connections that RSLinx establishes to the CompactLogix controller. RSLinx then funnels all of the tags through those five available connections.

Viewing the Number of Open Connections

You can see how many connections are made from your workstation to the CompactLogix controller in RSLinx by selecting “CIP Diagnostics” from the “Connections” menu. The Dispatching tab contains various CIP information, including the number of connections open to the CompactLogix controller.

Notes:

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If you experience a problem with a hardware module within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your module up and running:

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Supersedes Publication 1769-UM011B-EN-P - March 2004

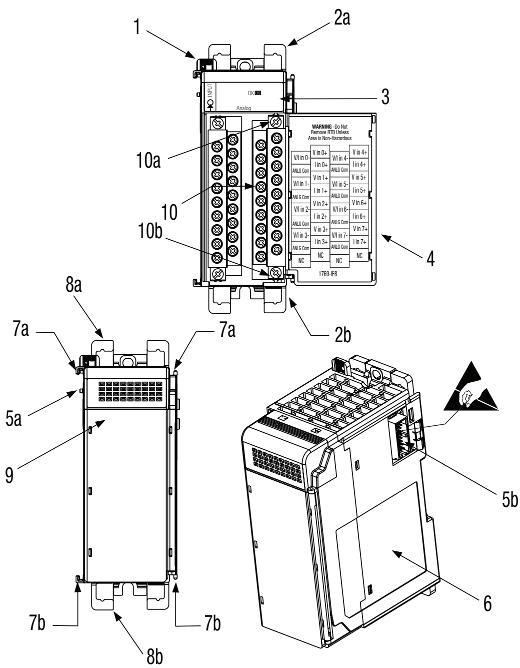
Installation Instructions

Compact™ 1769-IF8 Analog Input Module

Inside

Publication 1769-IN067A-EN-P - March 2004

Module Description



Item	Description
1	bus lever (with locking function)
2a	upper panel mounting tab
2b	lower panel mounting tab
3	module status LED
4	module door with terminal identification label
5a	movable bus connector with female pins
5b	stationary bus connector with male pins
6	nameplate label
7a	upper tongue-and-groove slots
7b	lower tongue-and-groove slots
8a	upper DIN rail latch
8b	lower DIN rail latch
9	write-on label (user ID tag)
10	removable terminal block (RTB) with finger-safe cover
10a	RTB upper retaining screw
10b	RTB lower retaining screw

Module Installation

Compact I/O is suitable for use in an industrial environment when installed in accordance with these instructions. Specifically, this equipment is intended for use in clean, dry environments (Pollution degree 2[1]) and to circuits not exceeding Over Voltage Category II[2] (IEC 60664-1).[3]

Prevent Electrostatic Discharge

ATTENTION

Electrostatic discharge can damage integrated circuits or semiconductors if you touch bus connector pins or the terminal block. Follow these guidelines when you handle the module:

- Touch a grounded object to discharge static potential.
- Wear an approved wrist-strap grounding device.
- Do not touch the bus connector or connector pins.
- Do not touch circuit components inside the module.
- If available, use a static-safe work station.
- When not in use, keep the module in its static-shield box.

Remove Power

ATTENTION

Remove power before removing or inserting this module. When you remove or insert a module with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system's field devices, causing unintended machine motion
- causing an explosion in a hazardous environment

Electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

(1) Pollution Degree 2 is an environment where, normally, only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation shall be expected.

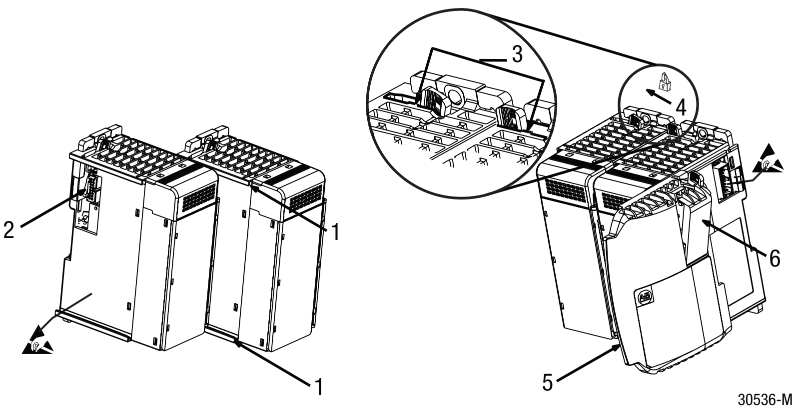
(2) Over Voltage Category II is the load level section of the electrical distribution system. At this level transient voltages are controlled and do not exceed the impulse voltage capability of the product's insulation.

(3) Pollution Degree 2 and Over Voltage Category II are International Electrotechnical Commission (IEC) designations.

System Assembly

The module can be attached to the controller or an adjacent I/O module *before* or *after* mounting. For mounting instructions, see "Panel Mounting" on page 6, or "DIN Rail Mounting" on page 7. To work with a system that is already mounted, see "Replacing a Single Module within a System" on page 7.

The following procedure shows you how to assemble the Compact I/O system.



1. Disconnect power.

2. Check that the bus lever of the module to be installed is in the unlocked (fully right) position.

3. Use the upper and lower tongue-and-groove slots (1) to secure the modules together (or to a controller).

4. Move the module back along the tongue-and-groove slots until the bus connectors (2) line up with each other.

5. Push the bus lever back slightly to clear the positioning tab (3). Use your fingers or a small screwdriver.

6. To allow communication between the controller and module, move the bus lever fully to the left (4) until it clicks. Ensure it is locked firmly in place.

ATTENTION

When attaching I/O modules, it is very important that the bus connectors are securely locked together to ensure proper electrical connection.

7. Attach an end cap terminator (5) to the last module in the system by using the tongue-and-groove slots as before.

8. Lock the end cap bus terminator (6).

IMPORTANT

A 1769-ECR or 1769-ECL right or left end cap must be used to terminate the end of the communication bus.

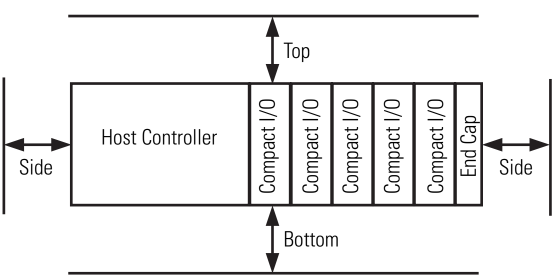
Mounting Expansion I/O

ATTENTION

During panel or DIN rail mounting of all devices, be sure that all debris (metal chips, wire strands, etc.) is kept from falling into the module. Debris that falls into the module could cause damage on power up.

Minimum Spacing

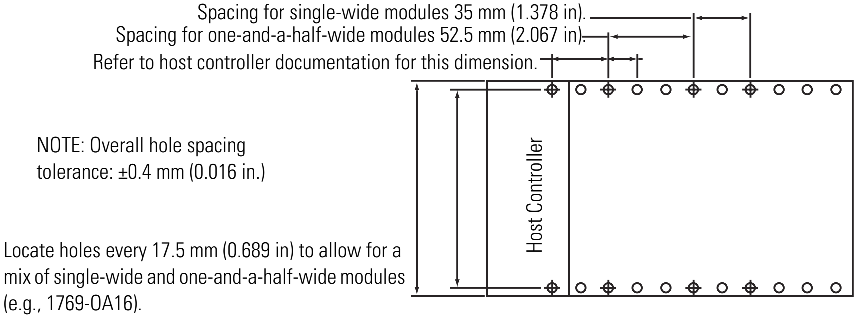
Maintain spacing from enclosure walls, wireways, adjacent equipment, etc. Allow 50 mm (2 in.) of space on all sides for adequate ventilation, as shown:



Panel Mounting

Mount the module to a panel using two screws per module. Use M4 or #8 panhead screws. Mounting screws are required on every module.

Panel Mounting Using the Dimensional Template



Panel Mounting Procedure Using Modules as a Template

The following procedure allows you to use the assembled modules as a template for drilling holes in the panel. If you have sophisticated panel mounting equipment, you can use the dimensional template provided on page 6. Due to module mounting hole tolerance, it is important to follow these procedures:

1. On a clean work surface, assemble no more than three modules.
2. Using the assembled modules as a template, carefully mark the center of all module-mounting holes on the panel.
3. Return the assembled modules to the clean work surface, including any previously mounted modules.
4. Drill and tap the mounting holes for the recommended M4 or #8 screw.
5. Place the modules back on the panel and check for proper hole alignment.
6. Attach the modules to the panel using the mounting screws.

NOTE If mounting more modules, mount only the last one of this group and put the others aside. This reduces remounting time during drilling and tapping of the next group.

7. Repeat steps 1 to 6 for any remaining modules.

DIN Rail Mounting

The module can be mounted using the following DIN rails: 35 x 7.5 mm (EN 50 022 - 35 x 7.5) or 35 x 15 mm (EN 50 022 - 35 x 15).

Before mounting the module on a DIN rail, close the DIN rail latches. Press the DIN rail mounting area of the module against the DIN rail. The latches will momentarily open and lock into place.

Replacing a Single Module within a System

The module can be replaced while the system is mounted to a panel (or DIN rail). Follow these steps in order:

1. Remove power. See important note on page 3.
2. On the module to be removed, remove the upper and lower mounting screws from the module (or open the DIN latches using a flat-blade or phillips-style screwdriver).
3. Move the bus lever to the right to disconnect (unlock) the bus.
4. On the right-side adjacent module, move its bus lever to the right (unlock) to disconnect it from the module to be removed.
5. Gently slide the disconnected module forward. If you feel excessive resistance, check that the module has been disconnected from the bus and that both mounting screws have been removed (or DIN latches opened).

NOTE	It may be necessary to rock the module slightly from front to back to remove it, or, in a panel-mounted system, to loosen the screws of adjacent modules.

6. Before installing the replacement module, be sure that the bus lever on the module to be installed, and on the right-side adjacent module are in the unlocked (fully right) position.
7. Slide the replacement module into the open slot.
8. Connect the modules together by locking (fully left) the bus levers on the replacement module and the right-side adjacent module.
9. Replace the mounting screws (or snap the module onto the DIN rail).

Module Spare/Replacement Parts

- Terminal block, catalog number 1769-RTBN18 (1 per kit)

Field Wiring Connections

Grounding the Module

This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the module's mounting tabs or DIN rail (if used), are not required unless the mounting surface cannot be grounded. Refer to *Industrial Automation Wiring and Grounding Guidelines*, Allen-Bradley publication 1770-4.1, for additional information.

System Wiring Guidelines

Consider the following when wiring your system:

- All module commons (ANLG COM) are connected in the analog module. The analog common (ANLG COM) is not connected to earth ground inside the module.
- Do not use the analog module's NC terminals as connection points.
- Channels are not isolated from each other.
- Use Belden™ 8761, or equivalent, shielded wire.
- Under normal conditions, the drain wire and shield junction must be connected to earth ground via a panel or DIN rail mounting screw at the analog I/O module end. Keep the shield connection to ground as short as possible.[1]
- To ensure optimum accuracy, limit overall cable impedance by keeping your cable as short as possible. Locate the I/O system as close to your sensors or actuators as your application will permit.
- If multiple power supplies are used with analog inputs, the power supply commons must be connected.
- The 1769-IF8 module does not provide loop power for analog inputs. Use a power supply that matches the input transmitter specifications.

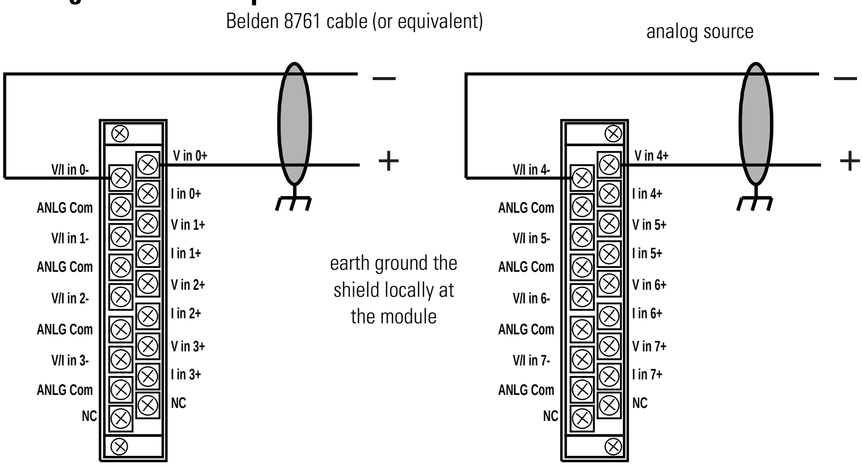
(1) In environments where high-frequency noise may be present, it may be necessary to directly ground cable shields to earth at the module end and via a 0.1μF capacitor at the sensor end.

- Differential analog inputs are more immune to noise than single-ended analog inputs.
- Voltages on Vin+, V/Iin-, and Iin+ of the 1769-IF8 module must be within ±10V dc of analog common.

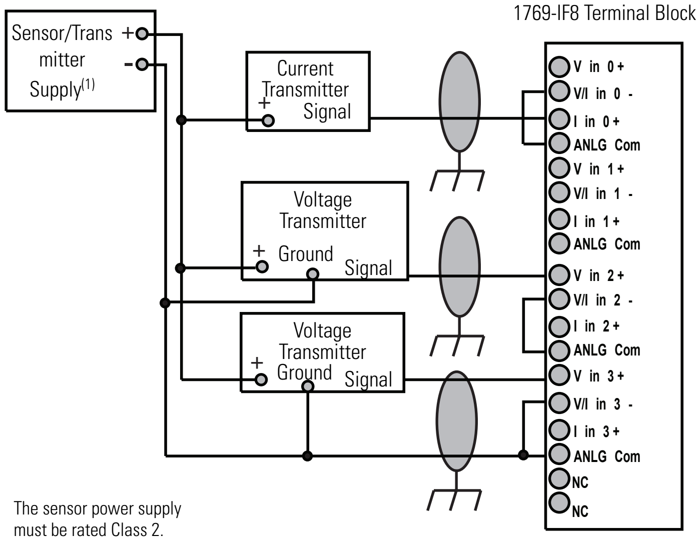
ATTENTION

Be careful when stripping wires. Wire fragments that fall into a module could cause damage at power up. Once wiring is complete, ensure the module is free of all metal fragments.

Wiring Differential Inputs



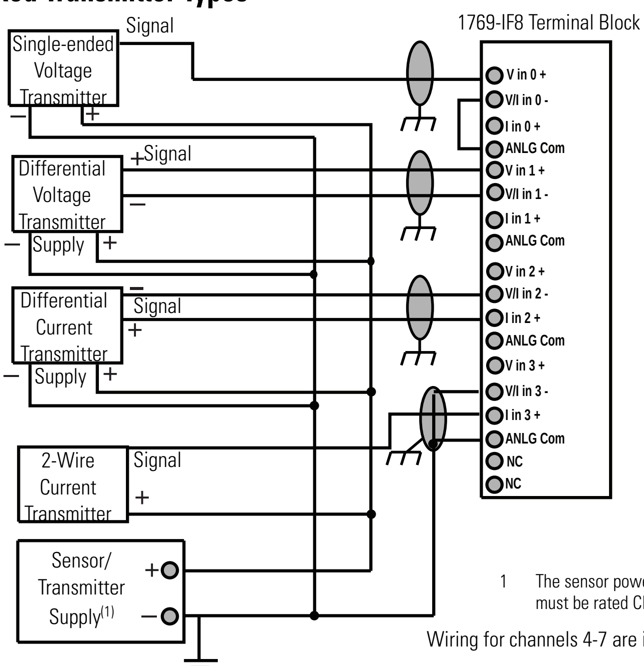
Wiring Single-Ended Sensor/Transmitter Types



1 The sensor power supply must be rated Class 2.

Wiring for channels 4-7 are identical.

Wiring Mixed Transmitter Types

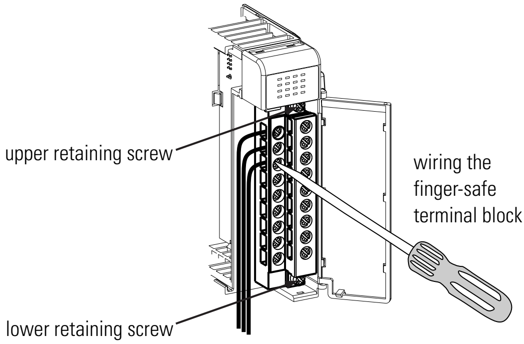


1 The sensor power supply must be rated Class 2.

Wiring for channels 4-7 are identical.

Labeling the Terminals

A removable, write-on label is provided with the module. Remove the label from the door, mark the identification of each terminal with permanent ink, and slide the label back into the door. Your markings (ID tag) will be visible when the module door is closed.



Removing the Finger-Safe Terminal Block

When wiring field devices to the module, it is not necessary to remove the terminal block. If you remove the terminal block, use the write-on label on the side of the terminal block to identify the module slot location and type. RTB position can be indicated by circling either the 'R' for right side or 'L' for left side.

To remove the terminal block, loosen the upper and lower retaining screws. The terminal block will back away from the module as you remove the screws. When replacing the terminal block, torque the retaining screws to 0.46 Nm (4.1 in-lbs).

Wiring the Finger-Safe Terminal Block

When wiring the terminal block, keep the finger-safe cover in place.

1. Loosen the terminal screws to be wired.
2. Route the wire under the terminal pressure plate. You can use the bare wire or a spade lug. The terminals will accept a 6.35 mm (0.25 in.) spade lug.

NOTE The terminal screws are non-captive. Therefore, it is possible to use a ring lug [maximum 1/4 inch o.d. with a 0.139 inch minimum i.d. (M3.5)] with the module.

3. Tighten the terminal screw making sure the pressure plate secures the wire. Recommended torque when tightening terminal screws is 0.68 Nm (6 in-lbs).

NOTE If you need to remove the finger-safe cover, insert a screw driver into one of the square wiring holes and gently pry the cover off. If you wire the terminal block with the finger-safe cover removed, you will not be able to put it back on the terminal block because the wires will be in the way.

Wire Size and Terminal Screw Torque

Each terminal accepts up to two wires with the following restrictions:

Wire Type		Wire Size	Terminal Screw Torque	Retaining Screw Torque
Solid	Cu-90°C (194°F)	#14 to #22 AWG	0.68 Nm (6 in-lbs)	0.46 Nm (4.1 in-lbs)
Stranded	Cu-90°C (194°F)	#16 to #22 AWG	0.68 Nm (6 in-lbs)	0.46 Nm (4.1 in-lbs)

I/O Memory Mapping

Input Data File

For each input module, slot x, words 0-7 in the input data file contain the analog values of the inputs.

Word	Bit Position															
	15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	SGN	Analog Input Data Channel 0														
1	SGN	Analog Input Data Channel 1														
2	SGN	Analog Input Data Channel 2														
3	SGN	Analog Input Data Channel 3														
4	SGN	Analog Input Data Channel 4														
5	SGN	Analog Input Data Channel 5														
6	SGN	Analog Input Data Channel 6														
7	SGN	Analog Input Data Channel 7														
8	Nu	Time Stamp Value														
9	Nu	Nu	Nu	Nu	Nu	Nu	Nu	Nu	S7	S6	S5	S4	S3	S2	S1	S0
10	L3	H3	U3	O3	L2	H2	U2	O2	L1	H1	U1	O1	L0	H0	U0	O0
11	L7	H7	U7	O7	L6	H6	U6	O6	L5	H5	U5	O5	L4	H4	U4	O4

The bits are defined as follows:

- SGN = Sign bit in two's complement format
- Nu = Not used. Bit set to 0.
- Sx = General status bit for input channels 0 through 7.
- Lx = Low alarm flag bits for input channels 0 through 7.
- Hx = High alarm flag bits for input channels 0 through 7.
- Ux = Under-range flag bits for channels 0 through 7. When set, the input signal is under normal range or an open circuit condition exists, in the case of the 4-20 mA range.
- Ox = Over-range flag bits for channels 0 through 7.

Configuration Data File

The manipulation of the bits from this file is normally done with programming software (e.g. RSLogix 500, RSNetworx for DeviceNet, etc.) during initial configuration of the system. In that case, graphical screens are provided by the programmer to simplify configuration. However, some systems, like the 1769-ADN DeviceNet Adapter, also allow the bits to be altered as part of the control program, using communication rungs. In that case, it is necessary to understand the bit arrangement. Refer to the *Compact™ Analog I/O User Manual*, publication number 1769-UM002 for additional details.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Real Time Sample Value															
1	ERTS	Reserved														
2	EC	Reserved				EA	AL	EI	Reserved				Input Filter Sel Chl0			
3	Reserved					Inpt Dta Fm Chl0			Reserved				Inpt Tp/RngeSel Chl0			
4	S	Process Alarm High Data Value Channel 0														
5	S	Process Alarm Low Data Value Channel 0														
6	S	Alarm Dead Band Value Channel 0														
7	Pad															
8	EC	Reserved				EA	AL	EI	Reserved				Inpt Filter Sel Chl1			
9	Reserved					Inpt Dta Fm Chl1			Reserved				Inpt Tp/RngeSel Chl1			
10	S	Process Alarm High Data Value Channel 1														
11	S	Process Alarm Low Data Value Channel 1														
12	S	Alarm Dead Band Value Channel 1														
13	Pad															
14	EC	Reserved				EA	AL	EI	Reserved				Input Filter Sel Chl2			
15	Reserved					Inpt Dta Fm Chl2			Reserved				Inpt Tp/RngeSel Chl2			
16	S	Process Alarm High Data Value Channel 2														
17	S	Process Alarm Low Data Value Channel 2														
18	S	Alarm Dead Band Value Channel 2														
19	Pad															
20	EC	Reserved				EA	AL	EI	Reserved				Input Filter Sel Chl3			
21	Reserved					Inpt Dta Fm Chl3			Reserved				Inpt Tp/RngeSel Chl3			
22	S	Process Alarm High Data Value Channel 3														
23	S	Process Alarm Low Data Value Channel 3														
24	S	Alarm Dead Band Value Channel 3														
25	Pad															
26	EC	Reserved				EA	AL	EI	Reserved				Input Filter Sel Chl4			
27	Reserved					Inpt Dta Fm Chl4			Reserved				Inpt Tp/RngeSel Chl4			

Word	Bit Position															
	15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
28	S	Process Alarm High Data Value Channel 4														
29	S	Process Alarm Low Data Value Channel 4														
30	S	Alarm Dead Band Value Channel 4														
31	Pad															
32	EC	Reserved				EA	AL	EI	Reserved				Input Filter Sel Chl5			
33	Reserved					Inpt Dta Fm Chl5			Reserved				Inpt Tp/RngeSel Chl5			
34	S	Process Alarm High Data Value Channel 5														
35	S	Process Alarm Low Data Value Channel 5														
36	S	Alarm Dead Band Value Channel 5														
37	Pad															
38	EC	Reserved				EA	AL	EI	Reserved				Input Filter Sel Chl6			
39	Reserved					Inpt Dta Fm Chl6			Reserved				Inpt Tp/RngeSel Chl6			
40	S	Process Alarm High Data Value Channel 6														
41	S	Process Alarm Low Data Value Channel 6														
42	S	Alarm Dead Band Value Channel 6														
43	Pad															
44	EC	Reserved				EA	AL	EI	Reserved				Input Filter Sel Chl7			
45	Reserved					Inpt Dta Fm Chl7			Reserved				Inpt Tp/RngeSel Chl7			
46	S	Process Alarm High Data Value Channel 7														
47	S	Process Alarm Low Data Value Channel 7														
48	S	Alarm Dead Band Value Channel 7														
49	Pad															

- EC = Enable Channel
- Inpt Dta Fm Chlx = Input Data Format Select.
- EA = Enable Alarm.
- AL = Alarm Latch.
- EI = Enable Interrupt.
- Inpt Tp/Rnge Sel Chlx = Input Type/Range Select.
- Inpt Filter Sel Chlx = Input Filter Select.
- Reserved = Allows for future expansion.
- ERTS = Enable Real Time Sample.

Define	To Select	Make these bit settings												
		15	14	13	12	11	10	9	8	7-4	3	2	1	0
Input Filter Selection/ -3 dB Frequency	60 Hz										0	0	0	0
	50 Hz										0	0	0	1
	10 Hz										0	0	1	0
	250 Hz										0	0	1	1
	500 Hz										0	1	0	0
Enable Interrupt	Enable								1					
	Disable								0					
Process Alarm Latch	Enable						1							
	Disable						0							
Enable Process Alarms	Enable					1								
	Disable					0								
Enable Channel	Enable	1												
	Disable	0												

Define	Indicate this	These bit settings								
		15-11	10	9	8	7-4	3	2	1	0
Input Range Select	-10 to +10V dc						0	0	0	0
	0 to 5V dc						0	0	0	1
	0 to 10V dc						0	0	1	0
	4 to 20 mA						0	0	1	1
	1 to 5V dc						0	1	0	0
	0 to 20 mA						0	1	0	1
Input Data Select	Raw/Proportional Counts		0	0	0					
	Engineering Units		0	0	1					
	Scaled for PID		0	1	0					
	Percent Range		0	1	1					

Specifications

General Specifications

Specification	Value
Dimensions	118 mm (height) x 87 mm (depth) x 52.5 mm (width) height including mounting tabs is 138 mm 4.65 in. (height) x 3.43 in (depth) x 2.07 in (width) height including mounting tabs is 5.43 in.
Approximate Shipping Weight (with carton)	450g (0.99 lbs.)
Storage Temperature	-40°C to +85°C (-40°F to +185°F)
Operating Temperature	0°C to +60°C (32°F to +140°F)
Operating Humidity	5% to 95% non-condensing
Operating Altitude	2000 meters (6561 feet)
Vibration	Operating: 10 to 500 Hz, 5G, 0.030 in. peak-to-peak
Shock	Operating: 30G, 11 ms panel mounted (20G, 11 ms DIN rail mounted) Non-Operating: 40G panel mounted (30G DIN rail mounted)
Agency Certification	• C-UL certified (under CSA C22.2 No. 142) • UL 508 listed • CE compliant for all applicable directives
Hazardous Environment Class	Class I, Division 2, Hazardous Location, Groups A, B, C, D (UL 1604, C-UL under CSA C22.2 No. 213)
Radiated and Conducted Emissions	EN50081-2 Class A
Electrical /EMC:	*The module has passed testing at the following levels:*
• ESD Immunity (IEC1000-4-2)	• 4 kV contact, 8 kV air, 4 kV indirect
• Radiated Immunity (IEC1000-4-3)	• 10 V/m , 80 to 1000 MHz, 80% amplitude modulation, +900 MHz keyed carrier
• Fast Transient Burst (IEC1000-4-4)	• 2 kV, 5kHz
• Surge Immunity (IEC1000-4-5)	• 1 kV galvanic gun
• Conducted Immunity (IEC1000-4-6)	• 10 V, 0.15 to 80MHz[1]

(1) Conducted Immunity frequency range may be 150 kHz to 30 MHz if the Radiated Immunity frequency range is 30 MHz to 1000 MHz.

Input Specifications

Specification	1769-IF8
Analog Normal Operating Ranges[1]	Voltage: ± 10V dc, 0 to 10V dc, 0 to 5V dc, 1 to 5V dc Current: 0 to 20 mA, 4 to 20 mA
Full Scale Analog Ranges[1]	Voltage: ± 10.5V dc, 0 to 10.5V dc, 0 to 5.25V dc, 0.5 to 5.25V dc Current: 0 to 21 mA, 3.2 to 21 mA
Number of Inputs	8 differential or single-ended
Bus Current Draw (max.)	120 mA at 5V dc 70 mA at 24V dc
Heat Dissipation	3.24 Total Watts (The Watts per point, plus the minimum Watts, with all points energized.)
Converter Type	Delta Sigma
Response Speed per Channel	Input filter and configuration dependent. See your user's manual.
Resolution (max.)[2]	16 bits (unipolar) 15 bits plus sign (bipolar)
Rated Working Voltage[3]	30V ac/30V dc
Common Mode Voltage Range[4]	±10V dc maximum per channel
Common Mode Rejection	greater than 60 dB at 50 and 60 Hz with the 10 Hz filter selected, respectively.
Normal Mode Rejection Ratio	-50 dB at 50 and 60 Hz with the 10 Hz filter selected, respectively.
Input Impedance	Voltage Terminal: 220K Ω (typical) Current Terminal: 250 Ω
Overall Accuracy[5]	Voltage Terminal: ±0.2% full scale at 25°C Current Terminal: ±0.35% full scale at 25°C

(1) The over- or under-range flag will come on when the normal operating range (over/under) is exceeded. The module will continue to convert the analog input up to the maximum full scale range. The flag automatically resets when within the normal operating range.

(2) Resolution is dependent upon your filter selection. The maximum resolution is achieved with the 10 Hz filter selected. For resolution with other filter selections, refer to the user manual, publication 1769-UM002A-EN-P.

(3) Rated working voltage is the maximum continuous voltage that can be applied at the input terminal, including the input signal and the value that floats above ground potential (for example, 10V dc input signal and 20V dc potential above ground).

(4) For proper operation, both the plus and minus input terminals must be within ±10V dc of analog common.

(5) Includes offset, gain, non-linearity and repeatability error terms.

Specification	1769-IF8
Accuracy Drift with Temperature	Voltage Terminal: ±0.003% per °C Current Terminal: ±0.0045% per °C
Calibration	The module performs autocalibration on channel enable and on a configuration change between channels.
Non-linearity (in percent full scale)	±0.03%
Repeatability[1]	±0.03%
Module Error over Full Temperature Range (0 to +60°C [+32°F to +140°F])	Voltage: ±0.3% Current: ±0.5%
Input Channel Configuration	via configuration software screen or the user program (by writing a unique bit pattern into the module's configuration file). Refer to your controller's user manual to determine if user program configuration is supported.
Module OK LED	On: module has power, has passed internal diagnostics, and is communicating over the bus. Off: Any of the above is not true.
Channel Diagnostics	Over- or under-range by bit reporting, process alarms
Maximum Overload at Input Terminals[2]	Voltage Terminal: ±30V dc continuous, 0.1 mA Current Terminal: ±32 mA continuous, ±7.6 V dc
System Power Supply Distance Rating	8 (The module may not be more than 8 modules away from the system power supply.)
Recommended Cable	Belden™ 8761 (shielded)
Input Group to Bus Isolation	500V ac or 710V dc for 1 minute (qualification test) 30V ac/30V dc working voltage (IEC Class 2 reinforced insulation)
Vendor I.D. Code	1
Product Type Code	10
Product Code	38

(1) Repeatability is the ability of the input module to register the same reading in successive measurements for the same input signal.

(2) Damage may occur to the input circuit if this value is exceeded.

Hazardous Location Considerations

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only. The following ATTENTION statement applies to use in hazardous locations.

WARNING

EXPLOSION HAZARD

- Substitution of components may impair suitability for Class I, Division 2.
- Do not replace components or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
- Do not connect or disconnect components unless power has been switched off or the area is known to be non-hazardous.
- This product must be installed in an enclosure.
- All wiring must comply with N.E.C. article 501-4(b).

Environnements dangereux

Cet équipement est conçu pour être utilisé dans des environnements de Classe 1, Division 2, Groupes A, B, C, D ou non dangereux. La mise en garde suivante s’applique à une utilisation dans des environnements dangereux.

AVERTISSEMENT

DANGER D’EXPLOSION

- La substitution de composants peut rendre cet équipement impropre à une utilisation en environnement de Classe 1, Division 2.
- Ne pas remplacer de composants ou déconnecter l'équipement sans s'être assuré que l'alimentation est coupée et que l'environnement est classé non dangereux.
- Ne pas connecter ou déconnecter des composants sans s'être assuré que l'alimentation est coupée ou que l'environnement est classé non dangereux.
- Ce produit doit être installé dans une armoire.

For More Information

For	Refer to this Document	Pub. No.
A more detailed description of how to install and use your Compact I/O with MicroLogix 1500 programmable controller.	MicroLogix 1500 Programmable Controllers User Manual	1764-UM001
Detailed information on installing, programming, and troubleshooting your Compact Analog I/O modules.	Compact I/O Analog Modules User Manual	1769-UM002
A detailed description of how to install and use your Compact I/O with the 1769-ADN DeviceNet Adapter.	1769-ADN DeviceNet Adapter User Manual	1769-UM001
An overview of the MicroLogix 1500 system, including Compact I/O.	MicroLogix 1500 Programmable Controller with Compact I/O for Expansion	1764-SO001
More information on proper wiring and grounding techniques.	Industrial Automation Wiring and Grounding Guidelines	1770-4.1

If you would like a manual, you can:

- download a free electronic version from the internet: **www.ab.com/micrologix** or **www.theautomationbookstore.com**
- purchase a printed manual by:

– contacting your local distributor or Rockwell Automation representative
– visiting **www.theautomationbookstore.com** and placing your order
– calling 1.800.963.9548 (USA/Canada)
or 001.330.725.1574 (Outside USA/Canada)

Notes:

Notes:

Rockwell Automation Support

Rockwell Automation provides technical information on the web to assist you in using our products. At http://support.rockwellautomation.com, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration and troubleshooting, we offer TechConnect Support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit http://support.rockwellautomation.com.

Installation Assistance

If you experience a problem with a hardware module within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your module up and running:

United States	1.440.646.3223 Monday – Friday, 8am – 5pm EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

New Product Satisfaction Return

Rockwell tests all of our products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned:

United States	Contact your distributor. You must provide a Customer Support case number (see phone number above to obtain one) to your distributor in order to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for return procedure.

www.rockwellautomation.com

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Europe: Rockwell Automation, Brühlstraße 22, D-74834 Elztal-Dallau, Germany, Tel: (49) 6261 9410, Fax: (49) 6261 17741
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Publication 1769-IN067A-EN-P - March 2004 PN 40071-171-01(1)

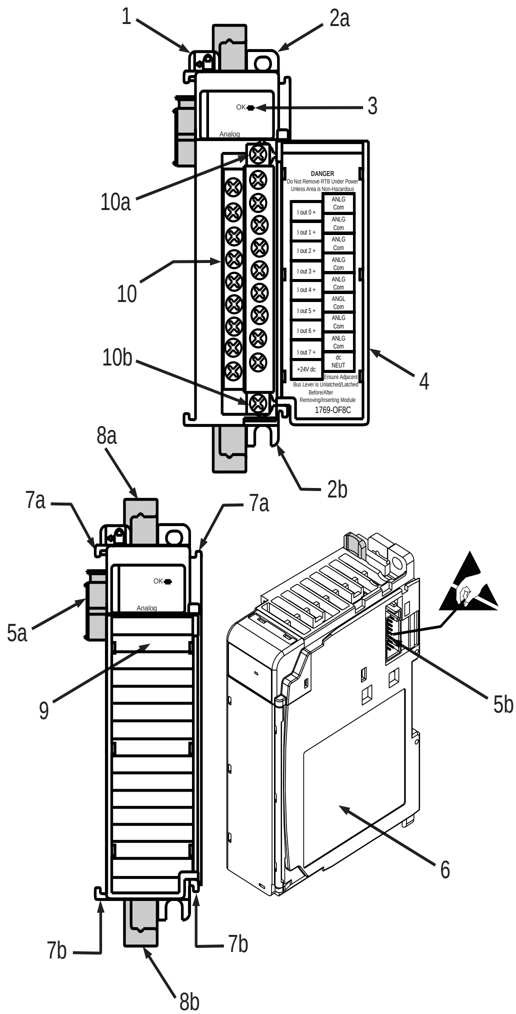
Installation Instructions

Compact™ 1769-OF8C Analog Output Module

Inside

Publication 1769-IN065A-EN-P - February 2004

Module Description



Item	Description
1	bus lever (with locking function)
2a	upper panel mounting tab
2b	lower panel mounting tab
3	module status LED
4	module door with terminal identification label
5a	movable bus connector with female pins
5b	stationary bus connector with male pins
6	nameplate label
7a	upper tongue-and-groove slots
7b	lower tongue-and-groove slots
8a	upper DIN rail latch
8b	lower DIN rail latch
9	write-on label (user ID tag)
10	removable terminal block (RTB) with finger-safe cover
10a	RTB upper retaining screw
10b	RTB lower retaining screw

Module Installation

Compact I/O is suitable for use in an industrial environment when installed in accordance with these instructions. Specifically, this equipment is intended for use in clean, dry environments (Pollution degree 2[1]) and to circuits not exceeding Over Voltage Category II[2] (IEC 60664-1).[3]

Prevent Electrostatic Discharge

ATTENTION

Electrostatic discharge can damage integrated circuits or semiconductors if you touch bus connector pins or the terminal block. Follow these guidelines when you handle the module:

- Touch a grounded object to discharge static potential.
- Wear an approved wrist-strap grounding device.
- Do not touch the bus connector or connector pins.
- Do not touch circuit components inside the module.
- If available, use a static-safe work station.
- When not in use, keep the module in its static-shield box.

Remove Power

ATTENTION

Remove power before removing or inserting this module. When you remove or insert a module with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system's field devices, causing unintended machine motion
- causing an explosion in a hazardous environment

Electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

(1) Pollution Degree 2 is an environment where, normally, only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation shall be expected.

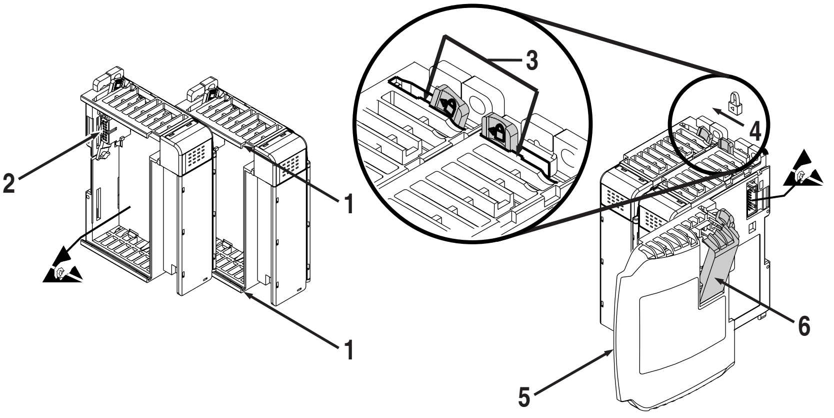
(2) Over Voltage Category II is the load level section of the electrical distribution system. At this level transient voltages are controlled and do not exceed the impulse voltage capability of the product's insulation.

(3) Pollution Degree 2 and Over Voltage Category II are International Electrotechnical Commission (IEC) designations.

System Assembly

The module can be attached to the controller or an adjacent I/O module *before* or *after* mounting. For mounting instructions, see “Panel Mounting” on page 6, or “DIN Rail Mounting” on page 7. To work with a system that is already mounted, see “Replacing a Single Module within a System” on page 7.

The following procedure shows you how to assemble the Compact I/O system.



1. Disconnect power.

2. Check that the bus lever of the module to be installed is in the unlocked (fully right) position.

3. Use the upper and lower tongue-and-groove slots (1) to secure the modules together (or to a controller).

4. Move the module back along the tongue-and-groove slots until the bus connectors (2) line up with each other.

5. Push the bus lever back slightly to clear the positioning tab (3). Use your fingers or a small screwdriver.

6. To allow communication between the controller and module, move the bus lever fully to the left (4) until it clicks. Ensure it is locked firmly in place.

ATTENTION

When attaching I/O modules, it is very important that the bus connectors are securely locked together to ensure proper electrical connection.

7. Attach an end cap terminator (5) to the last module in the system by using the tongue-and-groove slots as before.

8. Lock the end cap bus terminator (6).

IMPORTANT

A 1769-ECR or 1769-ECL right or left end cap must be used to terminate the end of the serial communication bus.

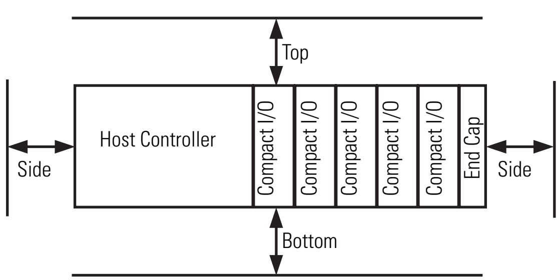
Mounting Expansion I/O

ATTENTION

During panel or DIN rail mounting of all devices, be sure that all debris (metal chips, wire strands, etc.) is kept from falling into the module. Debris that falls into the module could cause damage on power up.

Minimum Spacing

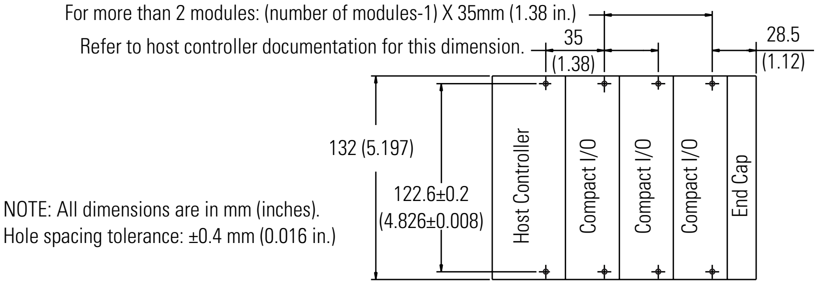
Maintain spacing from enclosure walls, wireways, adjacent equipment, etc. Allow 50 mm (2 in.) of space on all sides for adequate ventilation, as shown:



Panel Mounting

Mount the module to a panel using two screws per module. Use M4 or #8 panhead screws. Mounting screws are required on every module.

Panel Mounting Using the Dimensional Template



Panel Mounting Procedure Using Modules as a Template

The following procedure allows you to use the assembled modules as a template for drilling holes in the panel. If you have sophisticated panel mounting equipment, you can use the dimensional template provided on page 6. Due to module mounting hole tolerance, it is important to follow these procedures:

1. On a clean work surface, assemble no more than three modules.
2. Using the assembled modules as a template, carefully mark the center of all module-mounting holes on the panel.
3. Return the assembled modules to the clean work surface, including any previously mounted modules.
4. Drill and tap the mounting holes for the recommended M4 or #8 screw.
5. Place the modules back on the panel, and check for proper hole alignment.
6. Attach the modules to the panel using the mounting screws.

TIP	If mounting more modules, mount only the last one of this group and put the others aside. This reduces remounting time during drilling and tapping of the next group.

7. Repeat steps 1 to 6 for any remaining modules.

DIN Rail Mounting

The module can be mounted using the following DIN rails: 35 x 7.5 mm (EN 50 022 - 35 x 7.5) or 35 x 15 mm (EN 50 022 - 35 x 15).

Before mounting the module on a DIN rail, close the DIN rail latches. Press the DIN rail mounting area of the module against the DIN rail. The latches will momentarily open and lock into place.

Replacing a Single Module within a System

The module can be replaced while the system is mounted to a panel (or DIN rail). Follow the steps below in order:

1. Remove power. See important note on page 3.
2. On the module to be removed, remove the upper and lower mounting screws from the module (or open the DIN latches using a flat-blade or phillips-style screwdriver).
3. Move the bus lever to the right to disconnect (unlock) the bus.
4. On the right-side adjacent module, move its bus lever to the right (unlock) to disconnect it from the module to be removed.
5. Gently slide the disconnected module forward. If you feel excessive resistance, check that the module has been disconnected from the bus, and that both mounting screws have been removed (or DIN latches opened).

TIP It may be necessary to rock the module slightly from front to back to remove it, or, in a panel-mounted system, to loosen the screws of adjacent modules.

6. Before installing the replacement module, be sure that the bus lever on the module to be installed, and on the right-side adjacent module are in the unlocked (fully right) position.
7. Slide the replacement module into the open slot.
8. Connect the modules together by locking (fully left) the bus levers on the replacement module and the right-side adjacent module.
9. Replace the mounting screws (or snap the module onto the DIN rail).

Module Spare/Replacement Parts

- Terminal block, catalog number 1769-RTBN12 (1 per kit) (A-B part number A22112-319-01)
- Door, catalog number 1769-RD (2 per kit)

Field Wiring Connections

Grounding the Module

This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the module's mounting tabs or DIN rail (if used), are not required unless the mounting surface cannot be grounded. Refer to *Industrial Automation Wiring and Grounding Guidelines*, Allen-Bradley publication 1770-4.1, for additional information.

System Wiring Guidelines

Consider the following when wiring your system:

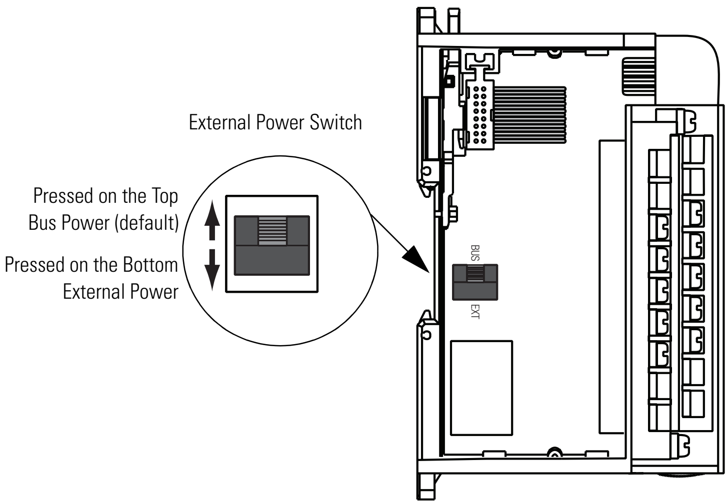
- All module commons (ANLG COM) are connected in the analog module. The analog common (ANLG COM) is not connected to earth ground inside the module.
- Channels are not isolated from each other.
- Use Belden™ 8761, or equivalent, shielded wire.
- Under normal conditions, the drain wire and shield junction must be connected to earth ground, via a panel or DIN rail mounting screw at the analog I/O module end. Keep the shield connection to ground as short as possible.[1]
- To ensure optimum accuracy, limit overall cable impedance by keeping your cable as short as possible. Locate the I/O system as close to your sensors or actuators as your application will permit.
- Current outputs (Iout 0+ to Iout 7+) of the 1769-OF8C module source current that returns to ANLG COM. Load resistance for a current output channel must remain between 0 and 500Ω.

(1) In environments where high frequency noise may be present, it may be necessary to ground the shield via a 0.1µF capacitor at the load end and also ground the module end without a capacitor.

External Power Switch

The 1769-OF8C has an external 24V dc power switch which gives you the option of using an external power supply. The switch is located in on the lower left portion of the module's circuit board, as shown below. With this switch pressed on the top (default), 24V dc power is drawn from the 1769 system power supply via the 1769 I/O bus. Pressed on the bottom, 24V dc power is drawn from the external power supply.

Wire the external power supply to the module via the module's terminal block. The external power supply must be rated Class 2, with a 24V dc range of 20.4 to 26.4V dc and 160 mA minimum.

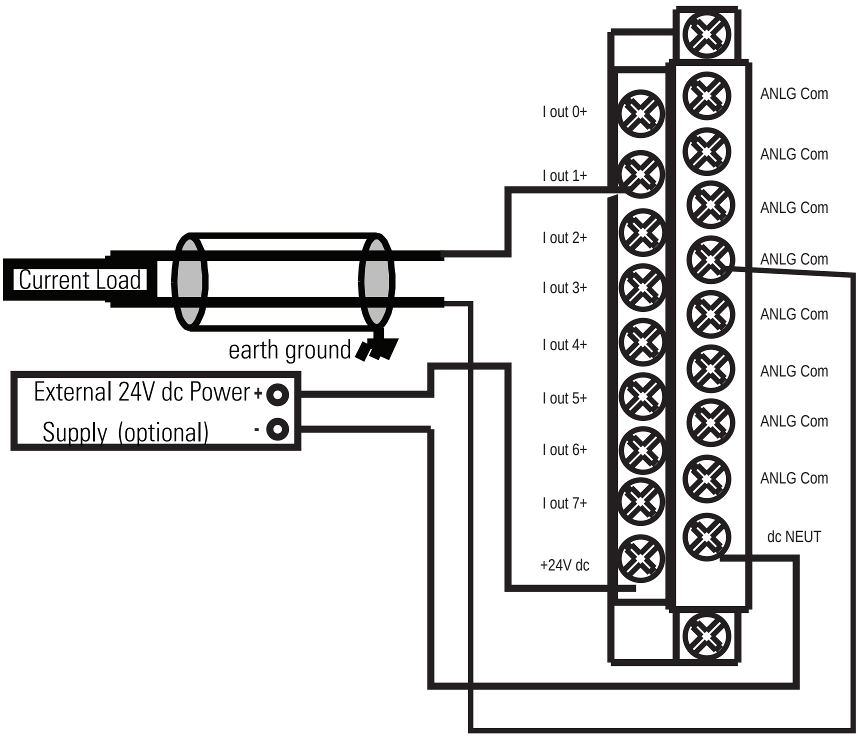


Wiring Output Devices

Basic wiring of output devices is shown below.

ATTENTION

- Miswiring of the module to an AC/DC source will damage the module.
- Be careful when stripping wires. Wire fragments that fall into a module could cause damage at power up. Once wiring is complete, ensure the module is free of all metal fragments.

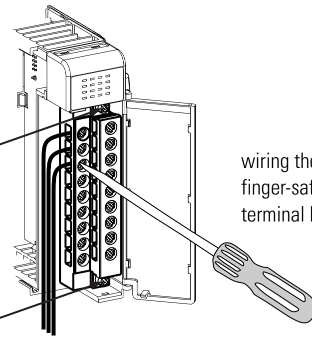


Labeling the Terminals

A removable, write-on label is provided with the module. Remove the label from the door, mark the identification of each terminal with permanent ink, and slide the label back into the door. Your markings (ID tag) will be visible when the module door is closed.

Removing the Finger-Safe Terminal Block

To remove the terminal block, loosen the upper and lower retaining screws. The terminal block will back away from the module as you remove the screws. When replacing the terminal block, torque the retaining screws to 0.46 Nm (4.1 in-lbs).



Wiring the Finger-Safe Terminal Block

When wiring the terminal block, keep the finger-safe cover in place.

1. Loosen the terminal screws to be wired.
2. Route the wire under the terminal pressure plate. You can use the bare wire or a spade lug. The terminals will accept a 6.35 mm (0.25 in.) spade lug.

TIP	The terminal screws are non-captive. Therefore, it is possible to use a ring lug [maximum 1/4 inch o.d. with a 0.139 inch minimum i.d. (M3.5)] with the module.

3. Tighten the terminal screw making sure the pressure plate secures the wire. Recommended torque when tightening terminal screws is 0.68 Nm (6 in-lbs).

TIP	If you need to remove the finger-safe cover, insert a screw driver into one of the square, wiring holes and gently pry the cover off. If you wire the terminal block with the finger-safe cover removed, you will not be able to put it back on the terminal block because the wires will be in the way.

Wire Size and Terminal Screw Torque

Each terminal accepts up to two wires with the following restrictions:

Wire Type		Wire Size	Terminal Screw Torque	Retaining Screw Torque
Solid	Cu-90°C (194°F)	#14 to #22 AWG	0.68 Nm (6 in-lbs)	0.46 Nm (4.1 in-lbs)
Stranded	Cu-90°C (194°F)	#16 to #22 AWG	0.68 Nm (6 in-lbs)	0.46 Nm (4.1 in-lbs)

I/O Memory Mapping

Output Data File

For each module, slot x, words 0-7 in the output data file contain the channel 0 through 7 output data. Word 8 is used to unlatch any condition that has been latched. Refer to the *Compact™ Analog I/O User Manual*, publication number 1769-UM002 for additional details.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	SGN	Analog Output Data Channel 0														
1	SGN	Analog Output Data Channel 1														
2	SGN	Analog Output Data Channel 2														
3	SGN	Analog Output Data Channel 3														
4	SGN	Analog Output Data Channel 4														
5	SGN	Analog Output Data Channel 5														
6	SGN	Analog Output Data Channel 6														
7	SGN	Analog Output Data Channel 7														
8	UU7	UO7	UU6	UO6	UU5	UO5	UU4	UO4	UU3	UO3	UU2	UO2	UU1	UO1	UU0	UO0

- SGN = Sign bit in two's complement format.
- UU = Unlatch under-range (or low clamp exceeded) alarm.
- UO = Unlatch over-range (or high clamp exceeded) alarm.

Input Data File

For each module, slot x, input data file words 3-10 contain the state of the module's output data (output data echo) file words 0-7. During normal operation, these input words represent the analog values that the outputs are directed to by the control program.

Word	Bit Position															
	15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0								PF	S7	S6	S5	S4	S3	S2	S1	S0
1	D3	H3	U3	O3	D2	H2	U2	O2	D1	H1	U1	O1	D0	H0	U0	O0
2	D7	H7	U7	O7	D6	H6	U6	O6	D5	H5	U5	O5	D4	H4	U4	O4
3	Channel 0 Data Value															
4	Channel 1 Data Value															
5	Channel 2 Data Value															
6	Channel 3 Data Value															
7	Channel 4 Data Value															
8	Channel 5 Data Value															
9	Channel 6 Data Value															
10	Channel 7 Data Value															

- PF = Analog power fail.
- S = General status (over-range, under-range, or open-circuit).
- D = Open-circuit diagnostics.
- H = Output held bit.
- U = Under-range (or low-clamp exceeded) alarm.
- O = Over-range (or high-clamp exceeded) alarm.

IMPORTANT The output module's input data file reflects the analog output data echo of the module, not necessarily the electrical state of the output terminals. It does not reflect shorted or open outputs.

Configuration Data File

The manipulation of the bits from this file is normally done with programming software (e.g. RSLogix 500, RSNetworx for DeviceNet, etc.) during initial configuration of the system. In that case, graphical screens are provided by the programmer to simplify configuration. However, some systems, like the 1769-ADN DeviceNet Adapter, also allow the bits to be altered as part of the control program, using communication rungs. In that case, it is necessary to understand the bit arrangement. The channel configuration words, the first two words of each eight word group, are described on page 16. Refer to the *Compact™ Analog I/O User Manual*, publication number 1769-UM002 for additional details.

Word	Description	Word	Description
0	Channel 0 Configuration Word 0	24	Channel 3 Configuration Word 0
1	Channel 0 Configuration Word 1	25	Channel 3 Configuration Word 1
2	Channel 0 Fault Value Word	26	Channel 3 Fault Value Word
3	Channel 0 Program Idle Mode Word	27	Channel 3 Program Idle Mode Word
4	Channel 0 Low Clamp	28	Channel 3 Low Clamp
5	Channel 0 High Clamp	29	Channel 3 High Clamp
6	Channel 0 Ramp Rate	30	Channel 3 Ramp Rate
7	Channel 0 Spare	31	Channel 3 Spare
8	Channel 1 Configuration Word 0	32	Channel 4 Configuration Word 0
9	Channel 1 Configuration Word 1	33	Channel 4 Configuration Word 1
10	Channel 1 Fault Value Word	34	Channel 4 Fault Value Word
11	Channel 1 Program Idle Mode Word	35	Channel 4 Program Idle Mode Word
12	Channel 1 Low Clamp	36	Channel 4 Low Clamp
13	Channel 1 High Clamp	37	Channel 4 High Clamp
14	Channel 1 Ramp Rate	38	Channel 4 Ramp Rate
15	Channel 1 Spare	39	Channel 4 Spare
16	Channel 2 Configuration Word 0	40	Channel 5 Configuration Word 0
17	Channel 2 Configuration Word 1	41	Channel 5 Configuration Word 1
18	Channel 2 Fault Value Word	42	Channel 5 Fault Value Word
19	Channel 2 Program Idle Mode Word	43	Channel 5 Program Idle Mode Word
20	Channel 2 Low Clamp	44	Channel 5 Low Clamp
21	Channel 2 High Clamp	45	Channel 5 High Clamp
22	Channel 2 Ramp Rate	46	Channel 5 Ramp Rate
23	Channel 2 Spare	47	Channel 5 Spare

Word	Description	Word	Description
48	Channel 6 Configuration Word 0	56	Channel 7 Configuration Word 0
49	Channel 6 Configuration Word 1	57	Channel 7 Configuration Word 1
50	Channel 6 Fault Value Word	58	Channel 7 Fault Value Word
51	Channel 6 Program Idle Mode Word	59	Channel 7 Program Idle Mode Word
52	Channel 6 Low Clamp	60	Channel 7 Low Clamp
53	Channel 6 High Clamp	61	Channel 7 High Clamp
54	Channel 6 Ramp Rate	62	Channel 7 Ramp Rate
55	Channel 6 Spare	63	Channel 7 Spare

<table>
<tr><th>Word/Bit</th><th>15</th><th>14</th><th>13</th><th>12</th><th>11</th><th>10</th><th>9</th><th>8</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>Word 0</td><td>E</td><td colspan="7">Reserved</td><td>SIU</td><td>SIO</td><td>LA</td><td>ER</td><td>FM</td><td>PM</td><td>HI</td><td>PFE</td></tr>
<tr><td>Word 1</td><td colspan="5">Reserved</td><td colspan="3">Output Data Format Select</td><td colspan="5">Reserved</td><td colspan="3">Output Type/Range</td></tr>
</table>

- E = Channel Enable: (0 = Disabled, 1 = output 0 and hold Enabled, process changes)
- Reserved = Set to zero
- SIU = System interrupt low clamp, under-range alarms: (0 = Disabled, 1 = Enabled)
- SIO = System interrupt high clamp, over-range alarms: (0 = Disabled, 1 = Enabled)
- LA = Latch low/high clamp, under/over-range alarms: (0 = Disabled, 1 = Enabled)
- ER = Enable ramping: (0 = Disabled, 1 = Enabled. Ramp rate limited by fault states.)
- FM = Fault mode: (0 = Hold Last State, 1 = User Defined Value)
- PM = Program mode: (0 = Hold Last State, 1 = User Defined Value)
- HI = Hold for initialization: (0 = Disabled, 1 = Enabled)
- PFE = Program/idle to fault enable: (0 = Disabled, 1 = Enabled)

Channel Configuration Words

The first two words of each eight word group in the configuration file allow you to change the parameters of each channel independently. For example, words 8 and 9 correspond to channel 1 while words 56 and 57 correspond to channel 7.

Define	Indicate this	These bit settings															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Program (Idle) to Fault Enable	Program (Idle) Mode Data Applied(1)		0	0	0	0	0	0	0	0							0
	Fault Mode Data Applied(1)		0	0	0	0	0	0	0	0							1
Hold for Initialization	Disabled		0	0	0	0	0	0	0	0						0	
	Enabled		0	0	0	0	0	0	0	0						1	
Program (Idle) Mode	Hold Last State(1)		0	0	0	0	0	0	0	0					0		
	User-Defined Value(1)		0	0	0	0	0	0	0	0					1		
Fault Mode	Hold Last State(1)		0	0	0	0	0	0	0	0				0			
	User-Defined Fault Value(1)		0	0	0	0	0	0	0	0				1			
Enable Ramping	Disabled		0	0	0	0	0	0	0	0			0				
	Enabled		0	0	0	0	0	0	0	0			1				
System Interrupt High Clamp	Disabled		0	0	0	0	0	0	0	0		0					
	Enabled		0	0	0	0	0	0	0	0		1					
System Interrupt Low Clamp	Disabled		0	0	0	0	0	0	0	0	0						
	Enabled		0	0	0	0	0	0	0	0	1						
Enable Channel	Disabled	0	0	0	0	0	0	0	0	0							
	Enabled	1	0	0	0	0	0	0	0	0							

(1) These functions are not supported by all controllers (e.g. MicroLogix 1500) using any configuration method. Refer to your controller manual for details.

Define	Indicate this	These bit settings															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Output Range Select	0 to 20 mA dc	0	0	0	0	0				0	0	0	0	0	0	0	0
	4 to 20 mA dc	0	0	0	0	0				0	0	0	0	0	0	0	1
Output Data Select	Raw/Proportional Counts	0	0	0	0	0	0	0	0	0	0	0	0	0			
	Engineering Units	0	0	0	0	0	0	0	1	0	0	0	0	0			
	Scaled for PID	0	0	0	0	0	0	1	0	0	0	0	0	0			
	Percent Range	0	0	0	0	0	0	1	1	0	0	0	0	0			

Specifications

General Specifications

Specification	Value
Dimensions	118 mm (height) x 87 mm (depth) x 35 mm (width) height including mounting tabs is 138 mm 4.65 in. (height) x 3.43 in (depth) x 1.38 in (width) height including mounting tabs is 5.43 in.
Approximate Shipping Weight (with carton)	281g (0.62 lbs.)
Storage Temperature	-40°C to +85°C (-40°F to +185°F)
Operating Temperature	0°C to +60°C (32°F to +140°F)
Operating Humidity	5% to 95% non-condensing
Operating Altitude	2000 meters (6561 feet)
Vibration	Operating: 10 to 500 Hz, 5G, 0.030 in. peak-to-peak Relay Operation: 2G
Shock	Operating: 30G, 11 ms panel mounted (20G, 11 ms DIN rail mounted) Non-Operating: 40G panel mounted (30G DIN rail mounted)
Agency Certification	• C-UL certified (under CSA C22.2 No. 142) • UL 508 listed • CE compliant for all applicable directives
Hazardous Environment Class	Class I, Division 2, Hazardous Location, Groups A, B, C, D (UL 1604, C-UL under CSA C22.2 No. 213)
Radiated and Conducted Emissions	EN50081-2 Class A
Electrical /EMC:	*The module has passed testing at the following levels:*
• ESD Immunity (IEC1000-4-2)	• 4 kV contact, 8 kV air, 4 kV indirect
• Radiated Immunity (IEC1000-4-3)	• 10 V/m, 80 to 1000 MHz, 80% amplitude modulation, +900 MHz keyed carrier
• Fast Transient Burst (IEC1000-4-4)	• 2 kV, 5 kHz
• Surge Immunity (IEC1000-4-5)	• 1 kV galvanic gun
• Conducted Immunity (IEC1000-4-6)	• 10V dc, 0.15 to 80 MHz[1]

(1) Conducted Immunity frequency range may be 150 kHz to 30 MHz if the Radiated Immunity frequency range is 30 MHz to 1000 MHz.

Output Specifications

Specification	1769-OF8C
Analog Normal Operating Ranges(1)	0 to 20 mA, 4 to 20 mA
Full Scale Analog Ranges(1)	0 to 21 mA, 3.2 to 21 mA
Number of Outputs	8 single-ended
Bus Current Draw (max.)	145 mA at 5V dc 160 mA at 24V dc(2)
Heat Dissipation	2.69 Total Watts *(All points - 21 mA into 250Ω - worst case calculated.)*
Digital Resolution Across Full Range	16 bits (unipolar) +4 to +20 mA: 15.59 bits, 0.323 μA/bit 0 to +20 mA: 15.91 bits, 0.323 μA/bit
Conversion Rate (all channels) max.	5 ms
Step Response to 63%(3)	<2.9 ms
Resistive Load on Current Output	0 to 500 Ω (includes wire resistance)
Max. Inductive Load	0.1 mH
Field Calibration	None required
Overall Accuracy(4)	±0.35% full scale at 25°C

(1) The over- or under-range flag will come on when the normal operating range (over/under) is exceeded. The module will continue to convert the analog input up to the maximum full scale range. The flag automatically resets when within the normal operating range unless configured to latch.

(2) If the optional 24V dc Class 2 power supply is used, the 24V dc current draw from the bus is 0 mA.

(3) Step response is the period of time between when the D/A converter was instructed to go from minimum to full range until the device is at 63% of full range.

(4) Includes offset, gain, drift, non-linearity and repeatability error terms.

Specification	1769-OF8C
Accuracy Drift with Temperature	±0.0058% FS per °C
Output Ripple(1) range 0 to 50 kHz (referred to output range)	±0.05%
Non-linearity (in percent full scale)	±0.05%
Repeatability(2) (in percent full scale)	±0.05%
Output Error Over Full Temperature Range (0 to 60°C [+32 to +140°F])	Current: ±0.55%
Output Offset Error (0 to 60°C [+32 to +140°F])	±0.05%
Output Impedance	>1 MΩ
Open and Short-Circuit Protection	Yes
Maximum Short-Circuit Current	21 mA
Output Overvoltage Protection	Yes
Time to Detect Open Wire Condition	5 ms
Output Response at System Power Up and Power Down	± 0.5V dc spike for < 5 ms
Rated Working Voltage(3)	30V ac/30V dc
Output Group to Bus Isolation	500V ac or 710V dc for 1 minute (qualification test) 30V ac/30V dc working voltage (IEC Class 2 reinforced insulation)
Module OK LED	On: module has power, has passed internal diagnostics, and is communicating over the bus. Flashing: external power failure. Off: Any of the above is not true.
Channel Diagnostics	Over- or under-range by bit reporting output wire broken or load resistance high by bit reporting

(1) Output ripple is the amount a fixed output varies with time, assuming a constant load and temperature.

(2) Repeatability is the ability of the output module to reproduce output readings when the same controller value is applied to it consecutively, under the same conditions and in the same direction.

(3) Rated working voltage is the maximum continuous voltage that can be applied at the input terminal, including the input signal and the value that floats above ground potential (for example, 10V dc input signal and 20V dc potential above ground).

Specification	1769-OF8C
System Power Supply Distance Rating	The module may not be more than 8 modules away from the system power supply.
Optional 24V dc Class 2 Power Supply Voltage Range[(1)]	20.4 V to 26.4 V dc
Recommended Cable	Belden™ 8761 (shielded)
Vendor I.D. Code	1
Product Type Code	10
Product Code	40
Input Words	11
Output Words	9
Configuration Words	64

(1) Failure to use a Class 2 power supply without regulation within these limits could result in improper module operation.

Hazardous Location Considerations

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only. The following ATTENTION statement applies to use in hazardous locations.

ATTENTION

EXPLOSION HAZARD

- Substitution of components may impair suitability for Class I, Division 2.
- Do not replace components or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
- Do not connect or disconnect components unless power has been switched off or the area is known to be non-hazardous.
- This product must be installed in an enclosure.

All wiring must comply with N.E.C. article 501-4(b).

Environnements dangereux

Cet équipement est conçu pour être utilisé dans des environnements de Classe 1, Division 2, Groupes A, B, C, D ou non dangereux. La mise en garde suivante s'applique à une utilisation dans des environnements dangereux.

ATTENTION

DANGER D'EXPLOSION

- La substitution de composants peut rendre cet équipement impropre à une utilisation en environnement de Classe 1, Division 2.
- Ne pas remplacer de composants ou déconnecter l'équipement sans s'être assuré que l'alimentation est coupée et que l'environnement est classé non dangereux.
- Ne pas connecter ou déconnecter des composants sans s'être assuré que l'alimentation est coupée ou que l'environnement est classé non dangereux.

Ce produit doit être installé dans une armoire.

For More Information

For	Refer to this Document	Pub. No.
A more detailed description of how to install and use your Compact I/O with MicroLogix 1500 programmable controller.	MicroLogix 1500 Programmable Controllers User Manual	1764-UM001A-US-P
Detailed information on installing, programming, and troubleshooting your Compact Analog I/O modules.	Compact I/O Analog Modules User Manual	1769-UM002A-EN-P
A detailed description of how to install and use your Compact I/O with the 1769-ADN DeviceNet Adapter.	1769-ADN DeviceNet Adapter User Manual	1769-UM001A-US-P
An overview of the MicroLogix 1500 system, including Compact I/O.	MicroLogix 1500 Programmable Controller with Compact I/O for Expansion	1764-SO001B-EN-P
More information on proper wiring and grounding techniques.	Industrial Automation Wiring and Grounding Guidelines	1770-4.1

If you would like a manual, you can:

- download a free electronic version from the internet: **www.ab.com/micrologix** or **www.theautomationbookstore.com**
- purchase a printed manual by:
  - contacting your local distributor or Rockwell Automation representative
  - visiting **www.theautomationbookstore.com** and placing your order
  - calling 1.800.963.9548 (USA/Canada) or 001.330.725.1574 (Outside USA/Canada)

Notes:

Rockwell Automation Support

Rockwell Automation provides technical information on the web to assist you in using our products. At http://support.rockwellautomation.com, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration and troubleshooting, we offer TechConnect Support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit http://support.rockwellautomation.com.

Installation Assistance

If you experience a problem with a hardware module within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your module up and running:

United States	1.440.646.3223 Monday – Friday, 8am – 5pm EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

New Product Satisfaction Return

Rockwell tests all of our products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned:

United States	Contact your distributor. You must provide a Customer Support case number (see phone number above to obtain one) to your distributor in order to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for return procedure.

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Installation Instructions

1769-L32E, -L35E CompactLogix™ Controller

(Catalog Numbers 1769-L32E, 1769-L35E)

Inside...

Publication 1769-IN020B-EN-P - March 2004

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.ab.com/manuals/gi) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual we use notes to make you aware of safety considerations.

WARNING	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you: • identify a hazard • avoid a hazard • recognize the consequence
SHOCK HAZARD	Labels may be located on or inside the drive to alert people that dangerous voltage may be present.
SHOCK HAZARD	Labels may be located on or inside the drive to alert people that surfaces may be dangerous temperatures.

Environment and Enclosure Information

ATTENTION

Environment and Enclosure

This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC publication 60664-1), at altitudes up to 2000 meters without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR Publication 11. Without appropriate precautions, there may be potential difficulties ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbance.

This equipment is supplied as "open type" equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

See NEMA Standards publication 250 and IEC publication 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure. Also, see the appropriate sections in this publication, as well as the Allen-Bradley publication 1770-4.1 ("Industrial Automation Wiring and Grounding Guidelines"), for additional installation requirements pertaining to this equipment.

North American Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations:	**Informations sur l'utilisation de cet équipement en environnements dangereux :**
Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.	Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.
WARNING **EXPLOSION HAZARD** • Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. • Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. • Substitution of components may impair suitability for Class I, Division 2. • If this product contains batteries, they must only be changed in an area known to be nonhazardous.	**AVERTISSEMENT** **RISQUE D'EXPLOSION** • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit. • La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2. • S'assurer que l'environnement est classé non dangereux avant de changer les piles.

Before You Begin

Use this document as a guide for installing and powering-up your 1769-L32E, -L35E CompactLogix controller. You should already be familiar with the system components.

You must FLASH upgrade the firmware on your CompactLogix controller before you can use it. The controller ships with firmware revision 1.x but must be upgraded to match the version of RSLogix 5000 that you are using (e.g. if you are using RSLogix 5000 V13, you must upgrade your CompactLogix controller firmware to revision 13.x before using it. For more information on upgrading your controller's firmware, see page 21.

How to Handle CompactLogix Components

ATTENTION

Preventing Electrostatic Discharge

This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- If available, use a static-safe workstation.
- When not in use, store the equipment in appropriate static-safe packaging.

Make Sure that You Have All the Components

These components ship with the controller:

Component:	Description:
	1769-BA battery **Important:** The 1769-BA battery is the only battery you can use with the 1769-L32E, -L35E controller.
	1747-KY controller key

You may also use these components with the controller:

If you want to:	Then use this component:
connect a device to the RS-232 port	1756-CP3 or 1747-CP3 serial cable
connect a device to the EtherNet/IP port	standard Ethernet cable with RJ-45 connector
Add nonvolatile memory	1784-CF64 Industrial CompactFlash card

System Planning

Consider the following when planning your CompactLogix system:

- The CompactLogix controller is always the left-most module in the system.
- The controller must be located within four modules of the system power supply. Some I/O module's may be located up to 8 modules away from the power supply. See the documentation for your 1769 I/O modules for details.
- The 1769-L32E controller supports as many as 16 I/O modules in a maximum of 3 I/O banks with 2 expansion cables.

  The 1769-L35E controller supports as many as 30 I/O modules in a maximum of 3 I/O banks with 2 expansion cables.
- Each I/O bank requires its own power supply.
- Only one controller can be used in a CompactLogix system.
- A 1769-ECR (right end cap) or 1769-ECL (left end cap) is required to terminate the end of the communication bus.

Installation Steps

✓	**Installation Step:**	**See Page:**
❑ **1.**	Connect the battery	7
❑ **2.**	Install the 1784-CF64 CompactFlash card (optional)	8
❑ **3.**	Assemble the system	9
❑ **4.**	Mount the system	10
❑ **5.**	Make serial connections	13
❑ **6.**	Make Ethernet connections	16
❑ **7.**	Install the appropriate EDS files	20
❑ **8.**	Load controller firmware	21

Connect the 1769-BA Battery

The controller is shipped with the 1769-BA battery packed separately. To connect the battery, follow the procedure shown below.

ATTENTION

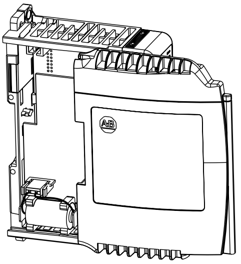
The 1769-BA battery is the only battery you can use with the 1769-L32, -L35E controller. The 1747-BA battery is not compatible with the 1769-L32E, -L35E controller and may cause problems.

1. Slide the battery door forward.

IMPORTANT

Do not remove the plastic insulation covering the battery. The insulation is necessary to protect the battery contacts.

2. Insert the battery into the battery port. Insert the battery connector into the connector port. The connector is keyed to engage in the correct polarity.
3. Slide the battery door back until it clicks into position.



WARNING

When you connect or disconnect the battery an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

For Safety information on the handling of lithium batteries, including handling and disposal of leaking batteries, see *Guidelines for Handling Lithium Batteries*, publication AG 5-4.

Install a 1784-CF64 Industrial CompactFlash Card (optional)

ATTENTION

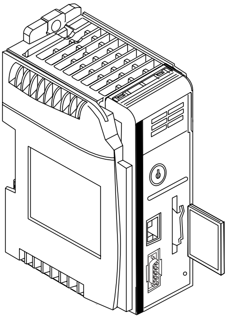
Do not remove the CompactFlash card while the controller is reading from or writing to the card, as indicated by a flashing green CF LED. This could corrupt the data on the card or in the controller, as well as corrupt the latest firmware in the controller.

A 1784-CF64 Industrial CompactFlash card provides nonvolatile memory for a CompactLogix controller. This is an optional feature and is not required to operate the controller. Install the card as follows:

1. Push the locking tab to the right and insert the 1784-CF64 Industrial CompactFlash card into the socket on the front of the controller.

   The label of the CompactFlash card faces towards the left. Match the orientation arrow on the card with the arrow on the front of the controller.

   The CompactFlash card supports removal and insertion under power.



WARNING

When you insert or remove the card while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding. Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

To remove the CompactFlash card, push the locking tab away from the CompactFlash card and pull the CompactFlash card from the socket.

Assemble the System

The controller can be attached to an adjacent I/O module or power supply *before* or *after* mounting. For mounting instructions, see Panel mounting on page 12 or DIN rail mounting on page 12.

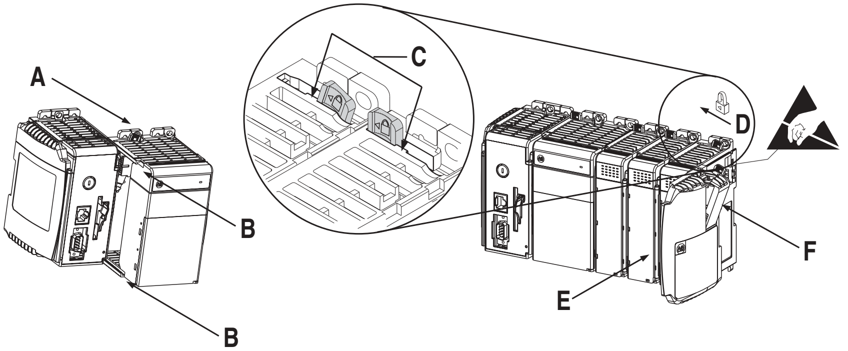
WARNING

The CompactLogix controller is not designed for removal and insertion under power.

If you connect or disconnect the communications cable while power is applied to this module or the wiring while the field-side power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

The following procedure shows you how to install the controller in a CompactLogix system.



1. Disconnect line power.

2. Check that the lever of the adjacent module (A) is in the unlocked (fully right) position.

3. Use the upper and lower tongue-and-groove slots (B) to secure the modules together.

4. Move the module back along the tongue-and-groove slots until the bus connectors line up with each other.

5. Use your fingers or a small screwdriver to push the module's bus lever back slightly to clear the positioning tab (C).

6. Move the module's bus lever fully to the left (D) until it clicks. Ensure it is locked firmly in place.

ATTENTION

When attaching the controller, power supply, and I/O modules, make sure the bus connectors are securely locked together to ensure proper electrical connection.

7. Attach an end cap terminator (E) to the last module in the system by using the tongue-and-groove slots as before.

8. Lock the end cap bus terminator (F).

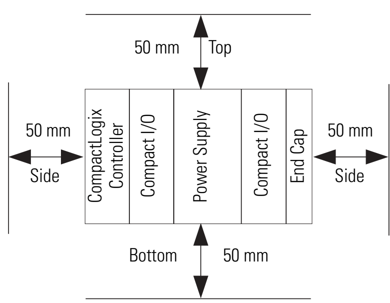
Mount the System

ATTENTION

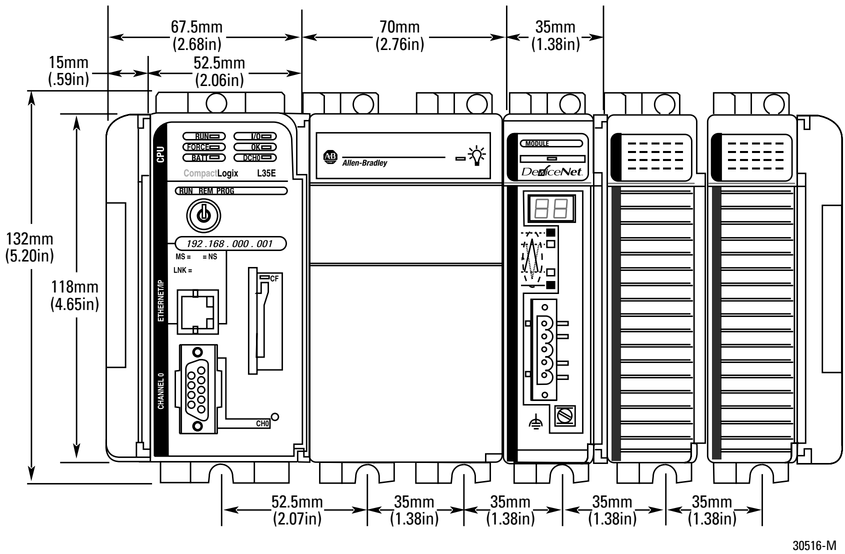
During panel or DIN rail mounting of all devices, be sure that all debris (metal chips, wire strands, etc.) is kept from falling into the controller. Debris that falls into the controller could cause damage while the controller is energized.

Minimum spacing

Maintain spacing from enclosure walls, wireways, adjacent equipment, etc. Allow 50 mm (2 in.) of space on all sides, as shown. This provides ventilation and electrical isolation.



System dimensions



NOTE: All dimensions are in mm (in.).
Hole spacing tolerance: ±0.4 mm (0.016 in.)

TIP

Compact I/O expansion cables have the same dimensions as the end caps. Expansion cables can be used on either the right or left end. A 1769-ECR (right end cap) or 1769-ECL (left end cap) terminates the end of the communication bus.

Panel mounting

Mount the controller to a panel using two screws per module. Use M4 or #8 panhead screws. Mounting screws are required on every module.

The following procedure allows you to use the assembled modules as a template for drilling holes in the panel. Due to module mounting hole tolerance, it is important to follow these procedures:

1. On a clean work surface, assemble no more than three modules.
2. Using the assembled modules as a template, carefully mark the center of all module-mounting holes on the panel.
3. Return the assembled modules to the clean work surface, including any previously mounted modules.
4. Drill and tap the mounting holes for the recommended M4 or #8 screw.
5. Place the modules back on the panel and check for proper hole alignment.
6. Attach the modules to the panel using the mounting screws.

TIP	If mounting more modules, mount only the last one of this group and put the others aside. This reduces remounting time during drilling and tapping of the next group.

7. Repeat steps 1 to 6 for any remaining modules.

DIN rail mounting

The controller can be mounted using the following DIN rails:

- 35 x 7.5 mm (EN 50 022 - 35 x 7.5)
- 35 x 15 mm (EN 50 022 - 35 x 15)

Before mounting the controller on a DIN rail, close the DIN rail latches. Press the DIN rail mounting area of the controller against the DIN rail. The latches will momentarily open and lock into place.

Grounding considerations

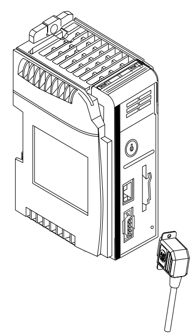
This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the controller's mounting tabs or DIN rail (if used), are not required unless the mounting surface cannot be grounded. Refer to *Industrial Automation Wiring and Grounding Guidelines*, Allen-Bradley publication 1770-4.1, for additional information.

ATTENTION

This product is grounded through the DIN rail to chassis ground. Use zinc plated yellow-chromate steel DIN rail to assure proper grounding. The use of other DIN rail materials (e.g. aluminum, plastic, etc.) that can corrode, oxidize, or are poor conductors, can result in improper or intermittent grounding.

Make RS-232 Connections to the Controller

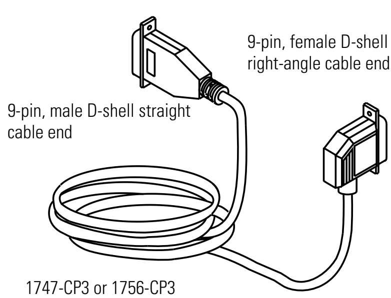
Connect the 9-pin female end of the serial cable to the serial port (bottom port, CH0) of the controller.

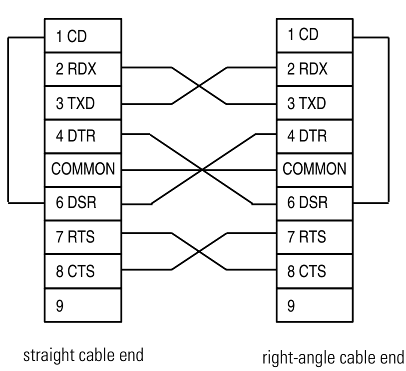


WARNING

If you connect or disconnect the serial cable with power applied to this module or the serial device on the other end of the cable, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.





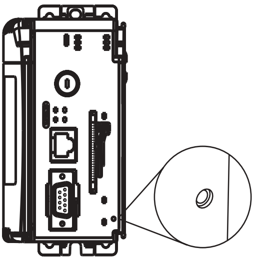
Default serial configuration

Channel 0 (serial) has the following default communication configuration.

Parameter	Default
Protocol	DF1 full-duplex
Baud Rate	19.2 Kbit/s
Parity	none
Station Address	0
Control Lines	no handshaking
Error Detection	BCC
Embedded Responses	auto detect
Duplicate Packet (Message) Detect	enabled
ACK Timeout	50 (x 20 ms)
NAK Receive Limit	3 retries
ENQ Transmit Limit	3 retries
Data Bits	8
Stop Bits	1

Using the channel 0 default communication push button

The Channel 0 Default Communication Push Button is located on the front of the controller in the lower right corner as shown in the illustration below.



Use the Channel 0 Default Communication Push Button to change from the user-defined communication configuration to the default communications mode. The Channel 0 Default Communications (DCH0) LED turns on (green, steady) to show when the default communication configuration is active.

TIP

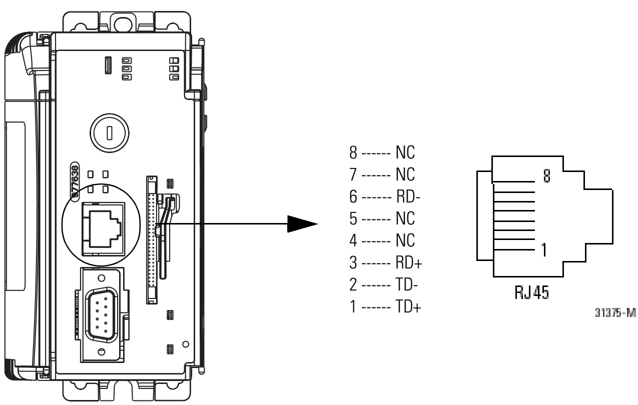
- The Default Communication Push Button is recessed.
- Before pressing the Default Communication Push Button, be sure to note the present communication configuration for Channel 0. Pushing the Default Communication Push Button resets all configured parameters back to their default settings. To return the channel to its user-configured parameters, you must enter them manually while online with the controller or download them as part of an RSLogix 5000 Project file. To accomplish this online using RSLogix 5000, enter the Controller Properties screen and use the Serial Port, System Protocol and User Protocol tabs.

Make Ethernet Connections to the Controller

The 1769-L32E, -L35E controller ships with BOOTP enabled. You must assign an IP address to the Ethernet port in order for the controller to communicate over an EtherNet/IP network. Connect the RJ-45 connector of the Ethernet cable to the Ethernet port (top port, CH1) on the controller.

ATTENTION

Do not plug a DH-485 network cable or a NAP port cable into the Ethernet port. Undesirable behavior and/or damage to the port may result.



Assign an IP address

You can set the IP address using either of these utilities:

- Rockwell BOOTP Utility (available with RSLinx and RSLogix 5000 software)
- RSLinx software
- RSLogix 5000 software

Using BOOTP to set the IP address

The BOOTP utility is a stand alone program that is located in the:

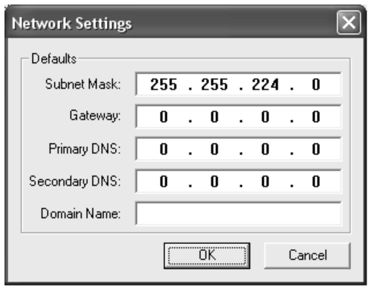
- RSLinx Tools directory in the Rockwell Software program folder on the Start menu (the utility is automatically installed when you install RSLinx software)
- Utils directory on the RSLogix 5000 installation CD.

To use the BOOTP utility.

1. Start the BOOTP software.

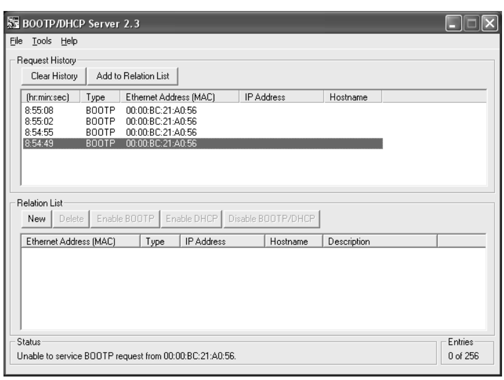
2. Select Tool → Network Settings.

   Enter the Ethernet mask and gateway. Click OK.

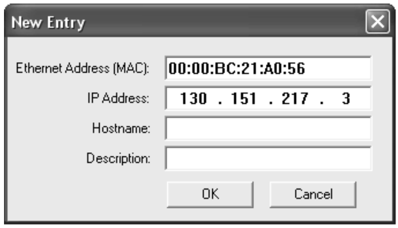


3. In the BOOTP Request History panel you see the hardware addresses of devices issuing BOOTP requests. Double-click on the hardware address of the device you want to configure.

   The hardware address is on the sticker located on the left-side circuit board of the controller next to the battery. See Connect the 1769-BA Battery on page 7 for instructions on accessing this area. The hardware address will be in this format: 00-0b-db-14-55-35.



4. The New Entry window appears with the device's Ethernet Address (MAC). Enter the IP address. Click OK.



5. To permanently assign this configuration to the device, highlight the device and click on the Disable BOOTP/DHCP button. When power is recycled, the device uses the configuration you assigned and not issue a BootP request.

Using RSLinx software to set the IP address

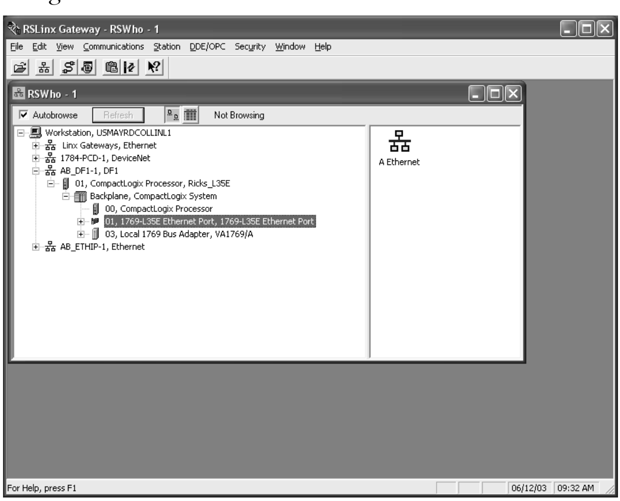
You can use RSLinx software, version 2.41 or higher, to set the IP address.

1. Make sure the controller that uses the IP address is installed and running.

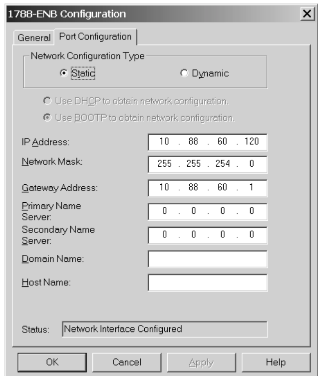
2. Connect to the controller via the serial connection (see page 13).

3. Start RSLinx. The RSWho window opens. Navigate in RSWho to the Ethernet network.

4. Right-click on the Ethernet port (not the controller) and select Module Configuration



5. Select the Port Configuration tab, choose the Status Network Configuration type, and enter the IP address, network (subnet) mask, and gateway address (if needed).



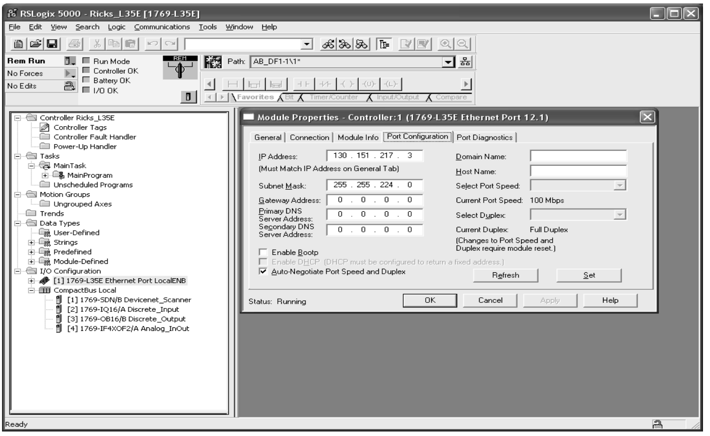
Using RSLogix 5000 software to set the IP address

You can use RSLogix software to set the IP address.

1. Make sure the controller that uses the IP address is installed and running.

2. Connect to the controller via the serial connection (see page 13).

3. Start RSLogix 5000 software. In the Controller Organizer, select properties for the Ethernet port.



4. Select the Port Configuration tab and specify the IP address and click Apply. Then click OK.

   This sets the IP address in the hardware. This IP address should be the same IP address you assigned under the General tab.

Install the Appropriate EDS Files

If you have RSLinx software, version 2.42 or greater, the most current EDS files were installed with the software. If you are using an older version of RSLinx software, you might need to install EDS files. You need EDS files for:

- 1769-L32E controller
- 1769-L32E EtherNet/IP port
- 1769-L35E controller
- 1769-L35E EtherNet/IP port
- 1769 CompactBus
- 1769 local adapter

All of these EDS files, except for the 1769 CompactBus file, are updated for each firmware revision. There is also a revision 1 of the EDS files that you need for new controllers. Each controller ships with revision 1 firmware. In order to update the firmware, you must have these revision 1 EDS files installed:

- 0001000E00410100.eds for the controller
- 0001000C00780100.eds for the EtherNet/IP port

The EDS files are available on the CD for RSLogix 5000 Enterprise Series software, version 13. The files are also available at:

http://www.ab.com/networks/eds.

Load the Controller Firmware

The controller ships without working firmware. You must download the current firmware before you can use the controller. To load firmware, you can use:

- ControlFlash utility that ships with RSLogix 5000 programming software.
- AutoFlash that launches through RSLogix 5000 software when you try to open or create a project and the controller does not have the current firmware.
- a 1784-CF64 CompactFlash card with valid memory already loaded.

The firmware is available with RSLogix 5000 software or you can download it from the support website:

1. Go to http://support.rockwellautomation.com

2. In the left column (frame), select Firmware Updates under Technical Support

3. Select the firmware revision.

   The download process will require you to enter the serial number of your RSLogix 5000 programming software.

If you load (flash) controller firmware via the ControlFlash or AutoFlash utilities, you need either a serial or EtherNet/IP connection to the controller. Flashing via an EtherNet/IP connection is faster than the serial connection. The controller's EtherNet/IP configuration settings are maintained during a flash process.

Using ControlFlash to load firmware

You can use ControlFlash to load firmware through either an Ethernet connection (an IP address must already be assigned to the Ethernet port) or a serial connection.

1. Make sure the appropriate network connection is made before starting.
2. Start the ControlFlash utility. Click Next when the Welcome screen appears.
3. Select the catalog number of the controller and click Next.

4. Expand the network until you see the controller. If the required network is not shown, first configure a driver for the network in RSLinx software.

   If you use an Ethernet connection to load the firmware (which is much faster than the serial connection), the utility will ask for a valid IP address before connecting to the controller.

5. Select the controller and click OK
6. Select the revision level to which you want to update the controller and click Next.
7. To start the update of the controller, click Finish and then click Yes.
8. After the controller is updated, the status box displays *Update complete*. Click OK.
9. To close ControlFlash software, click Cancel and then click Yes.

Using AutoFlash to load firmware

You can use AutoFlash to load firmware through either an Ethernet connection (an IP address must already be assigned to the Ethernet port) or a serial connection.

1. Make sure the appropriate network connection is made before starting.
2. Use RSLogix 5000 programming software to attempt to create a controller project. This automatically launches AutoFlash.
3. Select the catalog number of the controller and click Next.
4. Expand the network until you see the controller. If the required network is not shown, first configure a driver for the network in RSLinx software.

   If you use an Ethernet connection to load the firmware (which is much faster than the serial connection), the utility will ask for a valid IP address before connecting to the controller.

5. Select the controller and click OK
6. Select the revision level to which you want to update the controller and click Next.
7. To start the update of the controller, click Finish and then click Yes.
8. After the controller is updated, the status box displays *Update complete*. Click OK.
9. To close AutoFlash software, click Cancel and then click Yes.

Using a CompactFlash card to load firmware

If you have an existing controller that is already configured and has firmware loaded, you can store the current controller user program and firmware on CompactFlash and use that card to update other controllers.

1. Use RSLogix 5000 software to store the controller user program and firmware of a currently configured controller to the CompactFlash card.

   Access the Nonvolatile Memory tab of the Controller Properties dialog. Make sure to select Load Image On Powerup when you save to the card.

2. Remove the card and insert it into a controller that you want to have the same firmware and controller user program.

3. When you power up the second controller, the image stored on the CompactFlash card is loaded into the controller.

Select the Controller’s Operating Mode

Use the keyswitch on the front panel of the controller to determine the controller’s operating mode.

<table>
<tr><th>Keyswitch Position</th><th colspan="2">Description</th></tr>
<tr><td>RUN</td><td colspan="2">• Upload projects.
• Run the program and enable outputs.
• You cannot create or delete tasks, programs, or routines. You cannot create or delete tags or edit online while the keyswitch is in the RUN position.
• You cannot change the mode using the programming software while the keyswitch is in the RUN position.</td></tr>
<tr><td>PROG</td><td colspan="2">• Disable outputs.
• Upload/download projects.
• Create, modify, and delete tasks, programs, or routines.
• The controller does not execute (scan) tasks while the keyswitch is in the PROG position.
• You cannot change the mode through the programming software while the keyswitch is in the PROG position.</td></tr>
<tr><td rowspan="4">REM</td><td colspan="2">• Upload/download projects.
• Change between Remote Program, Remote Test, and Remote Run modes through the programming software.</td></tr>
<tr><td>Remote Run</td><td>• The controller executes (scans) tasks.
• Enable outputs.
• Edit online.</td></tr>
<tr><td>Remote Program</td><td>• Disable outputs.
• Create, modify, and delete tasks, programs or routines.
• Download projects.
• Edit online.
• The controller does not execute (scan) tasks.</td></tr>
<tr><td>Remote Test</td><td>• Execute tasks with outputs disabled.
• Edit online.</td></tr>
</table>

Controller LEDs

<table>
<tr><th>Indicator:</th><th>Color:</th><th>Description:</th></tr>
<tr><td>RUN</td><td>off</td><td>The controller is in Program or Test mode.</td></tr>
<tr><td></td><td>solid green</td><td>The controller is in Run mode.</td></tr>
<tr><td>FORCE</td><td>off</td><td>No tags contain I/O force values.
I/O forces are inactive (disabled).</td></tr>
<tr><td></td><td>solid amber</td><td>I/O forces are active (enabled).
I/O force values may or may not exist.</td></tr>
<tr><td></td><td>flashing amber</td><td>One or more input or output addresses have been forced to an On or Off state, but the forces have not been enabled.</td></tr>
<tr><td>BAT</td><td>off</td><td>The battery supports memory.</td></tr>
<tr><td></td><td>solid red</td><td>Either the battery is:
• not installed.
• 95% discharged and should be replaced.</td></tr>
<tr><td>I/O</td><td>off</td><td>Either:
• There are no devices in the I/O configuration of the controller.
• The controller does not contain a project (controller memory is empty).</td></tr>
<tr><td></td><td>solid green</td><td>The controller is communicating with all the devices in its I/O configuration.</td></tr>
<tr><td></td><td>flashing green</td><td>One or more devices in the I/O configuration of the controller are not responding.</td></tr>
<tr><td></td><td>flashing red</td><td>The controller is not communicating to any devices.
The controller is faulted.</td></tr>
<tr><td>OK</td><td>off</td><td>No power is applied.</td></tr>
<tr><td></td><td>flashing red</td><td><table><tr><th>If the controller is:</th><th>Then:</th></tr><tr><td>a new controller</td><td>the controller requires a firmware update</td></tr><tr><td>not a new controller</td><td>A major fault occurred.
To clear the fault, either:
- Turn the keyswitch from PROG to RUN to PROG
- Go online with RSLogix 5000 software</td></tr></table></td></tr>
<tr><td></td><td>solid red</td><td>The controller detected a non-recoverable fault, so it cleared the project from memory. To recover:
1. Cycle power to the chassis.
2. Download the project.
3. Change to Run mode.
If the OK LED remains solid red, contact your Rockwell Automation representative or local distributor.</td></tr>
<tr><td></td><td>solid green</td><td>Controller is OK.</td></tr>
<tr><td></td><td>flashing green</td><td>The controller is storing or loading a project to or from nonvolatile memory.</td></tr>
</table>

RS-232 serial port LEDs (channel 0)

Indicator:	Color:	Description:
DCH0	off	Channel 0 is configured differently than the default serial configuration.
	solid green	Channel 0 has the default serial configuration.
CH0	off	No RS-232 activity.
	flashing green	RS-232 activity.

CompactFlash card LED

ATTENTION

Do not remove the CompactFlash card while the controller is reading from or writing to the card, as indicated by a flashing green CF LED. This could corrupt the data on the card or in the controller, as well as corrupt the latest firmware in the controller.

Indicator:	Color:	Description:
CF	off	No activity.
	flashing green	The controller is reading from or writing to the CompactFlash card.
	flashing red	CompactFlash card does not have a valid file system.

EtherNet/IP LEDs

Module Status (MS) indicator

Condition:	Status:	Indicates:	Recommended Action:
off	no power	The controller does not have power.	Check the controller power supply.
flashing green	standby	The port does not have an IP address and is operating in BOOTP mode.	Verify that the BOOTP server is running.
solid green	OK	The port is operating correctly.	Normal operation. No action required.
solid red	held in reset	The controller is holding the port in reset or the controller is faulted.	Clear the controller fault. Replace the controller.
	self-test	The port is performing its power-up self-test.	Normal operation during power-up. No action required.
	major fault	An unrecoverable fault has occurred.	Cycle power to the controller. Replace the controller.
flashing red	updating firmware	The port firmware is being updated.	Normal operation during firmware update. No action required.

Network Status (NS) indicator

Condition:	Status:	Indicates:	Recommended Action:
off	not initialized	The port does not have an IP address and is operating in BOOTP mode.	Verify that the BOOTP server is running.
flashing green	no CIP connections established	The port has an IP address, but no CIP connections are established.	Normal operation if no connections are configured. No action required. If connections are configured, check connection originator for connection error code.
solid green	CIP connections established	The port has an IP address and CIP connections (Class 1 or Class 3) are established.	Normal operation. No action required.
solid red	duplicate IP address	The port has detected that the assigned IP address is already in use.	Verify that all IP addresses are unique.
flashing red/green	self-test	The port is performing its power-up self-test.	Normal operation during powerup.

Link Status (LNK) indicator

Condition:	Status:	Indicates:	Recommended Action:
off	no link	The port is not connected to a powered Ethernet device. The port cannot communicate on Ethernet.	Verify that all Ethernet cables are connected. Verify that Ethernet switch is powered.
flashing green	self-test	The port is performing its power-up self-test.	Normal operation during powerup.
	data transmission and reception	The port is communicating on Ethernet.	Normal operation. No action required.
solid green	link OK	The port is connected to a powered Ethernet device. The port can communicate on Ethernet.	Normal operation. No action required.

Specifications

Description	1769-L32E	1769-L35E
Communication Ports	**CH0 - RS-232** RS-232 DF1 38.4 Kbit/s maximum	**EtherNet/IP** RJ-45 or 10BaseT EtherNet/IP 10/100 MBytes/sec
User Memory	750 Kbytes	1.5 Mbytes
Nonvolatile Memory	1784-CF64 CompactFlash	
Maximum Number of I/O Modules	16 I/O modules	30 I/O modules
Maximum Number of I/O Banks	3 banks	3 banks
Backplane Current	660 mA at 5V dc 90 mA at 24V dc	660 mA at 5V dc 90 mA at 24V dc
Power Dissipation	4.74 W	4.74 W
Power Supply Distance Rating	4 (The controller must be within four slot positions of the power supply.)	
Battery	1769-BA	
Programming Cable	1747-CP3 or 1756-CP3	
Panel Mounting Screw Torque (using M4 or #8 screws)	10 - 16 in-lb (1.1 - 1.8 Nm)	
Enclosure Type Rating	none (open style)	
Wiring Category	2 on communication ports[1]	
Isolation Voltage (continuous-voltage withstand rating)	30V dc continuous Tested to withstand 710V dc for 60 sec	
Operational Temperature IEC 60068-2-1 (Test Ad, Operating Cold) IEC 60068-2-2 (Test Bd, Operating Dry Heat) IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0° to +60°C (+32° to +140°F)	
Storage Temperature IEC 60068-2-1 (Test Ab, Unpackaged Non-operating Cold) IEC 60068-2-2 (Test Bb, Unpackaged Non-operating Dry Heat) IEC 60068-2-14 (Test Na, Unpackaged Non-operating Thermal Shock)	-40° to +85°C (-40° to +185°F)	
Relative Humidity IEC 60068-2-30 (Test Db, Unpackaged Non-operating Damp Heat)	5% to 95% non-condensing	
Vibration IEC 60068-2-6 (Test Fc, Operating)	Operating: 5G @ 10-500Hz	
Shock IEC 60068-2-27 (Test Ea, Unpackaged Shock) DIN mount Panel mount	 Operating: 20G; Non-operating: 30G Operating: 30G; Non-operating: 40G	
Emissions	CISPR 11: Group 1, Class A	

Description	1769-L32E	1769-L35E
ESD Immunity (IEC61000-4-2)	4kV contact discharges, 8kV air discharges	
Radiated RF Immunity (IEC61000-4-3)	10V/M with 1kHz sine-wave 80%AM from 80MHz to 2000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900MHz 10V/m with 200Hz 50% Pulse 100%AM at 1890MHz	
EFT/B Immunity (IEC 61000-4-4)	±2kV at 5kHz on communication ports	
Surge Transient Immunity (IEC61000-4-5)	±2kV line-earth (CM) on shielded ports	
Conducted RF Immunity (IEC61000-4-6)	10Vrms with 1kHz sine-wave 80% AM from 150kHz to 80MHz	

(1) Use this Conductor Category information for planning conductor routing. See *Industrial Automation Wiring and Grounding Guidelines*, publication 1770-4.1.

Certifications

Certifications (when product is marked):	Description:
c-UL-us	UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada
CE[1]	European Union 89/336/EEC EMC Directive, compliant with: • EN 50082-2; Industrial Immunity • EN 61326; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions
C-Tick[1]	Australian Radio Communications Act, compliant with: • AS/NZS CISPR 11; Industrial Emissions

(1) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

Additional Information

Installation instructions ship with each component. If you want other documentation, you must order it separately. This product has the following manuals:

- *Logix5000 Controllers Common Procedures*, publication 1756-PM001
- *Logix5000 Controllers General Instructions Reference Manual*, publication 1756-RM003
- *Logix5000 Controllers Process Control and Drives Instructions Reference Manual*, publication 1756-RM006
- *CompactLogix System User Manual*, publication 1769-UM0011

If you want to:	Then:
view a manual download a manual	Visit either of these locations: • www.ab.com/manuals • www.theautomationbookstore.com
purchase a printed manual	Use one of these options: • contact your local distributor or Rockwell Automation representative • visit www.theautomationbookstore.com and place an order • call 800.963.9548 (USA/Canada) or 001.320.725.1574 (outside USA/Canada)

You can download:

- firmware from: support.rockwellautomation.com
- EDS files from: www.ab.com/networks/eds

Rockwell Automation Support

Rockwell Automation provides technical information on the web to assist you in using our products. At http://support.rockwellautomation.com, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration and troubleshooting, we offer TechConnect Support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit http://support.rockwellautomation.com.

Installation Assistance

If you experience a problem with a hardware module within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your module up and running:

United States	1.440.646.3223 Monday – Friday, 8am – 5pm EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

New Product Satisfaction Return

Rockwell tests all of our products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned:

United States	Contact your distributor. You must provide a Customer Support case number (see phone number above to obtain one) to your distributor in order to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for return procedure.

www.rockwellautomation.com

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CompactLogix Selection Guide

**1769-L35E, 1769-L32E,
1769-L31,
1769-L30, 1769-L20**

Rockwell Automation

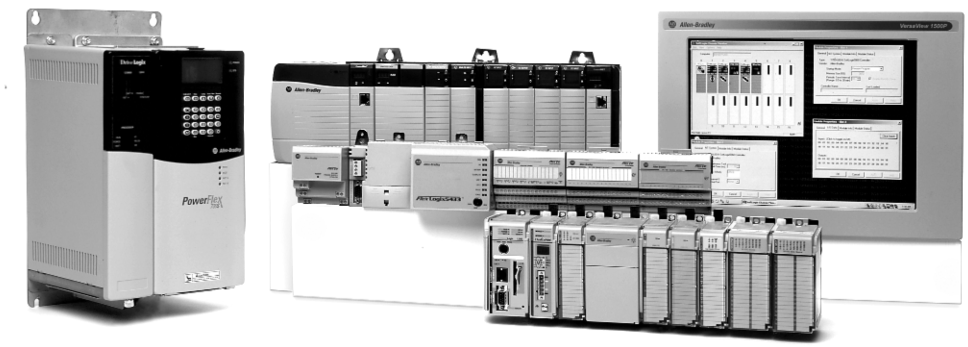
Logix Controllers Comparison

Common Characteristics	1756 ControlLogix™	1769 CompactLogix™	1789 SoftLogix5800™	1794 FlexLogix™	PowerFlex 700S® with DriveLogix
controller tasks: • continuous • periodic • event	• 32 tasks (only 1 continuous) • event tasks: supports all event triggers	• 1769-L35E: 8 tasks • 1769-L32E: 6 tasks • 1769-L31: 4 tasks • 1769-L20, -L30: 4 tasks • only 1 task can be continuous • event tasks: supports consumed tag trigger and EVENT instruction	• 32 tasks (only 1 continuous) • event tasks: supports all event triggers, plus outbound and Windows events	• 8 tasks (only 1 continuous) • event tasks: supports consumed tag trigger and EVENT instruction	• 8 tasks (only 1 continuous) • event tasks: supports axis and motion event triggers
user memory	1756-L55M12: 750 Kbytes 1756-L55M13: 1.5 Mbytes 1756-L55M14: 3.5 Mbytes 1756-L55M16: 7.5 Mbytes 1756-L55M22: 750 Kbytes 1756-L55M23: 1. 5 Mbytes 1756-L55M24: 3.5Mbytes 1756-L61: 2 Mbytes 1756-L62: 4 Mbytes 1756-L63: 8 Mbytes	1769-L20: 64 Kbytes 1769-L30: 256 Kbytes 1769-L31: 512 Kbytes 1769-L32E: 750 Kbytes 1769-L35E: 1.5 Mbytes	1789-L10: 2 Mbytes 3 slots no motion 1789-L30: 64 Mbytes 5 slots 1789-L60: 64 Mbytes 16 slots	1794-L33: 64 Kbytes 1794-L34: 512 Kbytes	256 Kbytes 768 Kbytes with memory expansion
nonvolatile user memory	1756-L55M12: none 1756-L55M13: none 1756-L55M14: none 1756-L55M16: none 1756-L55M22: yes 1756-L55M23: yes 1756-L55M24: yes 1756-L61: CompactFlash 1756-L62: CompactFlash 1756-L63: CompactFlash	1769-L20: yes 1769-L30: yes 1769-L31: CompactFlash 1769-L32E: CompactFlash 1769-L35E: CompactFlash	none	1794-L33: yes 1794-L34: yes	yes (expansion memory)
built-in communication ports	1 port RS- 232 serial (DF1 or ASCII)	• 1769-L20 has 1 RS-232 serial port (DF1 or ASCII) • 1769-L30, -L31 has 2 RS-232 ports (one DF1 only, other DF1 or ASCII) • 1769-L32E, -L35E has 1 EtherNet/IP port and 1 RS-232 serial port (DF1 or ASCII)	depends on personal computer	• 1 port RS-232 serial (DF1 or ASCII) • 2 slots for 1788 communication cards	• 1 port RS-232 serial (DF1 or ASCII) • 1 slot for 1788 communication cards
communication options(these options have specific products and profiles for their platform - other options are available via 3rd party products and generic profiles)	EtherNet/IP ControlNet DeviceNet Data Highway Plus Universal Remote I/ O serial Modbus via ladder routine DH-485 SynchLink	EtherNet/IP DeviceNet serial Modbus via ladder routine DH-485	EtherNet/IP ControlNet DeviceNet serial	EtherNet/IP ControlNet DeviceNet serial Modbus via ladder routine DH-485	EtherNet/IP ControlNet DeviceNet serial Modbus via ladder routine DH-485
controller redundancy	full redundancy support	not applicable	not applicable	controller hot backup via DeviceNet	not applicable
native I/O	1756 ControlLogix I/O	1769 Compact I/O	none	1794 FLEX I/O 1797 FLEX Ex I/O	1794 FLEX I/O 1797 FLEX Ex I/O
simple motion	stepper servo via DeviceNet analog ac drive	stepper servo via DeviceNet analog ac drive	stepper servo via DeviceNet analog ac drive	stepper servo via DeviceNet analog ac drive	stepper servo via DeviceNet analog ac drive
integrated motion	SERCOS interface analog interface hydraulic interface SSI interface	not applicable	SERCOS interface analog interface	not applicable	1 full servo 1 feedback axis
mounting and/or installation options	1756 chassis	panel mount DIN rail	none	panel mount DIN rail	embedded in PowerFlex 700S
programming languages	• relay ladder • structured text • function block • sequential function chart	• relay ladder • structured text • function block • sequential function chart	• relay ladder • structured text • function block • sequential function chart • external routines (Windows DLLs developed using C/C++)	• relay ladder • structured text • function block • sequential function chart	• relay ladder • structured text • function block • sequential function chart

Logix Platforms

Allen-Bradley Logix platforms provide a single integrated control architecture for discrete, drives, motion, and process control.

The Logix platforms provide a common control engine, programming software environment, and communication support across multiple hardware platforms. All Logix controllers operate with a multitasking, multiprocessing operating system and support the same set of instructions in multiple programming languages. One RSLogix™ 5000 programming software package programs all Logix controllers. And all Logix controllers incorporate the NetLinx Open Network Architecture to communicate via EtherNet/IP, ControlNet, and DeviceNet networks.



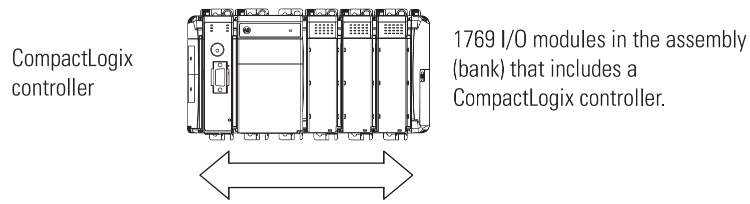
CompactLogix System Overview

What's New in Version 13:

- *1769-L31 controller with increased performance and I/O capacity*
- *1769-L32E controller with EtherNet/IP connectivity*
- *1769-L35C, -L35CR controller with ControlNet connectivity, due third quarter of 2004*
- *1769-IF8, 1769-OF8C, 1769-OF8V analog I/O modules*
- *support for a consumed tag trigger to launch an event task*

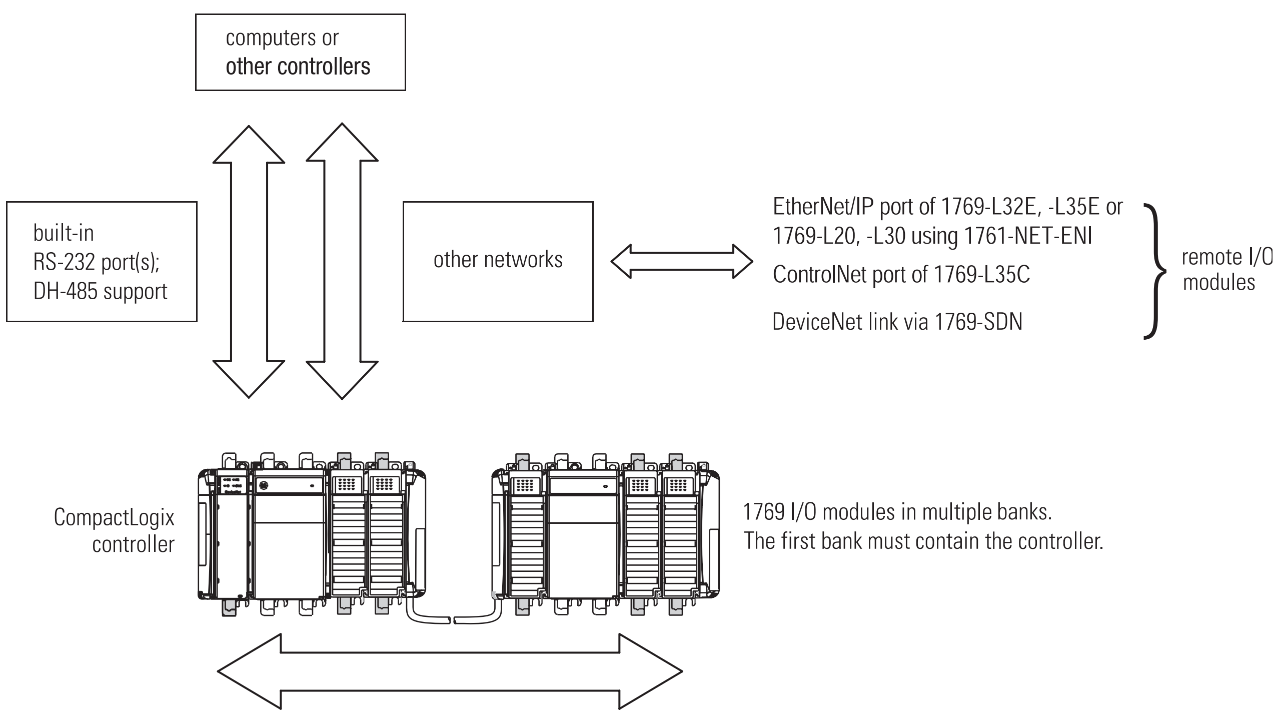
CompactLogix is designed to provide a Logix solution for low-end to medium applications. Typically, these applications are machine-level control applications that require limited I/O quantities and limited communications capabilities. The newer 1769-L3xx controllers expand CompactLogix capabilities and increase the number of supported I/O modules. The 1769-L32E and 1769-L35E controllers offer an integrated EtherNet/IP port.

A simple system can consist of only a stand-alone controller in a single bank of I/O modules and simple communication.



Multiple controllers can communicate across networks and share data.

- multiple controllers joined across networks
- I/O in multiple platforms that is distributed in many locations and connected in as many three different banks of I/O modules

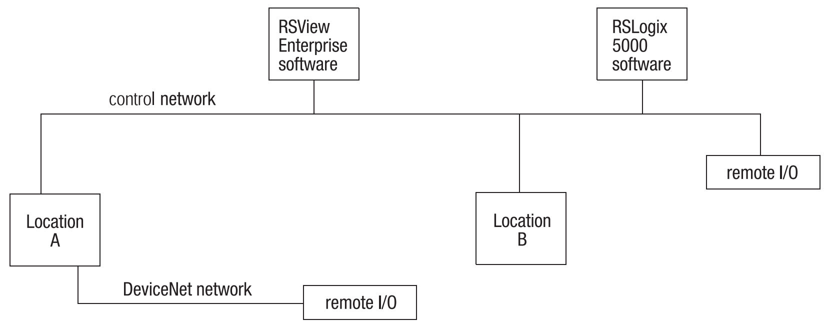


Layout the System

As you layout a system configuration, determine the network configuration and the placement of components in each location. Decide at this time whether each location will have its own controller.

Use the CompactLogix system to distribute control among different locations. You can remotely control I/O and field devices from a central CompactLogix controller over EtherNet/IP or DeviceNet.

For example, this system layout defines Location A and Location B, which each require a unique CompactLogix controller. Location A and Location B each have their own I/O modules. Location A also has some remote DeviceNet I/O devices, so that location will need a DeviceNet scanner, such as a 1769-SDN. Either EtherNet/IP can serve as the supervisory network to interlock Location A and Location B.



For Location A, if the supervisory network is EtherNet/IP, use a 1769-L35E or 1769-L32E controller because it can share data with the other devices on EtherNet/IP and can simultaneously support EtherNet/IP and DeviceNet communications. For Location B, use a 1769-L31, 1769 -L30, or 1769-L20 controller with a 1761-NET-ENI interface to connect to the EtherNet/IP network. Location B only needs to send messages. The lower functionality of the 1769-L31, -L30, -L20 controller offers cost savings over the 1769-L35E controller.

The 1769-L35E, -L32E, -L31 controllers offer significant performance and capacity improvements over the 1769-L20 and 1769-L30 controllers. These 1769-L3xx controllers are designed for mid-range applications. They offer:

- increased user memory up to 1.5 Mbytes
- CompactFlash for non-volatile memory storage
- extended I/O capacity up to 30 I/O modules
- increased backplane capacity and throughput resulting in the ability to mix and match any combination of digital, analog, and specialty I/O modules
- backplane messaging support
- EtherNet/IP support, including control of distributed I/O
- increased I/O performance allows 1ms backplane RPI under certain conditions

Specifying a System

Follow these steps as you specify your CompactLogix system:

✓	Step	See
	1 Select I/O devices Use a spreadsheet to record: • location of the device • number of points needed • appropriate catalog number • number of points available per module • number of modules **Important:** For 1769-L20, -L30 controllers, verify backplane memory use to make sure that the controller can support the proposed system. See the worksheet at the back of this guide.	I/O module specifications page 6 Wiring systems page 10 Placing I/O modules page 14 How I/O modules operate page 18 Selecting controller ownership page 18
	2 Select communication modules To the I/O spreadsheet, add the number and type of required communication modules.	Network overview page 19 EtherNet/IP specifications page 21 DeviceNet specifications page 23 Serial specifications page 25 DH-485 specifications page 26
	3 Select controllers Select the appropriate controller based on: • required controller tasks • type and number of I/O points needed • distributed I/O via EtherNet/IP • type and number of communication interfaces needed • performance of communication interfaces • required controller memory • type of nonvolatile memory • EtherNet/IP messaging support **Important:** The 1769-L3xx controllers offer considerably better performance and more I/O capacity than the 1769-L20, -L30 controllers. Make sure to consider these specifications when selecting the right controller.	Controller specifications page 27 Controlling devices page 29 Communicating with other devices page 30 Connection information page 31
	4 Select power supplies If power consumption exceeds the maximum for a single power supply, install additional power supplies.	Power supply specifications page 35
	5 Select the mounting requirements Determine whether to panel mount or DIN rail mount the CompactLogix system.	Planning the mounting requirements page 37
	6 Select software Based on the system design, determine the software products you need to configure and program your application.	Available software products page 41 Programming software page 42 Communication software page 44 Network configuration software page 45 Emulation software page 46 Visualization software and products page 47

Step 1 - Select:
- *I/O modules*
- *wiring system (if you want to use a wiring system instead of the terminal block that comes with module)*
- *PanelConnect modules and cables if connecting input modules to sensors*
- *expansion cables if planning multiple banks of I/O modules*

Selecting Compact I/O Modules

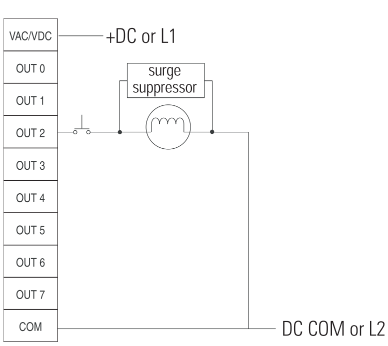
The 1769 Compact I/O modules can be used as local I/O for a CompactLogix controller. Install the I/O modules on a panel with two mounting screws or on a DIN rail. The modules mechanically lock together by means of a tongue-and-grove design and have an integrated communication bus that is connected from module to module by a moveable bus connector.

Each I/O module includes a built-in removable terminal block with finger-safe cover for connections to I/O sensors and actuators. The terminal block is behind a door at the front of the module. I/O wiring can be routed from beneath the module to the I/O terminals.

When planning I/O communications, consider:
- which Compact I/O modules to use
- where to place Compact I/O modules
- how Compact I/O modules operate

Digital I/O Modules

Type of Module	Description
input module	An input module responds to an input signal in the following manner: • Input filtering limits the effect of voltage transients caused by contact bounce and/or electrical noise. If not filtered, voltage transients could produce false data. All input modules use input filtering. • Optical isolation shields logic circuits from possible damage due to electrical transients. • Logic circuits process the signal. • An input LED turns on or off indicating the status of the corresponding input device.
output module	An output module controls the output signal in the following manner: • Logic circuits determine the output status. • An output LED indicates the status of the output signal. • Optical isolation separates module logic and bus circuits from field power. • The output driver turns the corresponding output on or off.



Most output modules have built-in surge suppression to reduce the effects of high-voltage transients. Use an additional suppression device if an output is being used to control inductive devices, such as relays, motor starters, solenoids, or motors. Additional suppression is especially important if your inductive device is in series with or parallel to hard contacts, such as push buttons or selector switches.

Add a suppression device directly across the coil of an inductive device to reduce the effects of voltage transients caused by interrupting the current to that device and to prolong the life of the switch contacts.

1769 Compact digital dc input modules

Cat. No.	Number of Inputs	Voltage Category/Type, Input	Voltage Range	Input Delay Time, ON to OFF	Current, On-State Input, Min.	Current, Off-State Input, Max.	Backplane Current (mA) at 5V	Power Supply Distance Rating (modules)
1769-IA8I	8 individually isolated	100 or 120V ac	79...132V ac @ 47...63Hz	20 ms	5 mA @ 79V ac	2.5 mA	90 mA	8 modules
1769-IA16	16	100 or 120V ac	79...132V ac @ 47-63Hz	20 ms	5 mA @ 79V ac	2.5 mA	115 mA	8 modules
1769-IM12	12	200 or 240V ac	159...265V ac @ 47-60Hz	20 ms	5 mA @ 159V ac	2.5 mA	100 mA	8 modules

1769 Compact digital ac output modules

Cat. No.	Number of Outputs	Voltage Category/Type, Output	Voltage Range	Current Leakage, Off-State Output, Max.	Current per Output, Max.	Current per Module, Max.	Backplane Current (mA) at 5V	Power Supply Distance Rating (modules)
1769-OA8	8	100…240V ac	85...265 ac @ 47-63Hz	2.0 mA at 132V ac 2.5 mA at 265V ac	0.25 A @ 60°C(140°F) 0.50 A @ 30°C(86°F)	2.0 A @ 60°C(140°F) 4.0 A @ 30°C(86°F)	145 mA	8 modules
1769-OA16	16	100...240V ac	85...265 ac @ 47-63Hz	2.0 mA at 132V ac 2.5 mA at 265V ac	0.25 A @ 60°C(140°F) 0.50 A @ 30°C(86°F)	4.0 A @ 60°C(140°F) 8.0 A @ 30°C(86°F)	225 mA	8 modules

1769 Compact digital dc input modules

Cat. No.	Number of Inputs	Voltage Category/Type, Input	Voltage Range	Input Delay Time, ON to OFF	Current, On-State Input, Min.	Current, Off-State Input, Max.	Backplane Current (mA) at 5V	Power Supply Distance Rating (modules)
1769-IQ6XOW4	6	24V dc, sinking or sourcing	10...30V dc @ 30°C(86°F) 10...26.4V dc @ 60°C(140°F)	8 ms	2 mA	1.5 mA	105 mA	8 modules
1769-IQ16	16	24V dc, sinking or sourcing	10...30V dc @ 30°C(86°F) 10...26.4V dc @ 60°C(140°F)	8 ms	2 mA	1.5 mA	115 mA	8 modules
1769-IQ16F	16 high-speed	24V dc, sinking or sourcing	10...30V dc @ 30°C(86°F) 10...26.4V dc @ 60°C(140°F)	1 ms	2 mA	1.5 mA	110 mA	8 modules
1769-IQ32	32	24V dc, sinking or sourcing	10...30V dc @ 30°C(86°F) 10...26.4V dc @ 60°C(140°F)	8 ms	2 mA	1.5 mA	170 mA	8 modules

1769 Compact digital dc output modules

Cat. No.	Number of Outputs	Voltage Category/Type, Output	Voltage Range	Current Leakage, Off-State Output, Max.	Current per Output, Max.	Current per Module, Max.	Backplane Current (mA) at 5V	Power Supply Distance Rating (modules)
1769-OB8	8	24V dc, sourcing	20.4...26.4 dc	1.0 mA @ 26.4V ac	2.0 A @ 60°C(140°F)	8.0 A @ 60°C(140°F)	145 mA	8 modules
1769-OB16	16	24V dc, sourcing	20.4...26.4 dc	1.0 mA @ 26.4V ac	0.5 A @ 60°C(140°F) 1.0 A @ 30°C(86°F)	4.0 A @ 60°C(140°F) 8.0 A @ 30°C(86°F)	200 mA	8 modules
1769-OB16P	16 protected	24V dc, sourcing	20.4...26.4 dc	1.0 mA @ 26.4V ac	0.5 A @ 60°C(140°F) 1.0 A @ 30°C(86°F)	4.0 A @ 60°C(140°F) 8.0 A @ 30°C(86°F)	160 mA†	8 modules
1769-OB32	32	24V dc, sourcing	20.4...26.4 dc	1.0 mA @ 26.4V ac	0.5 A @ 60°C(140°F) 1.0 A @ 30°C(86°F)	8.0 A @ 60°C(140°F) 16.0 A @ 30°C(86°F)	300 mA	6 modules
1769-OV16	16	24V dc, sinking	20.4...26.4 dc	1.0 mA @ 26.4V ac	0.5 A @ 60°C(140°F) 1.0 A @ 30°C(86°F)	4.0 A @ 60°C(140°F) 8.0 A @ 30°C(86°F)	200 mA	8 modules

1769 Compact digital contact output modules

Cat. No.	Number of Outputs	Voltage Category/Type, Output	Voltage Range	Current Leakage, Off-State Output, Max.	Current per Output, Max.	Current per Module, Max.	Backplane Current (mA) at 5V	Backplane Current (mA) at 24V	Power Supply Distance Rating (modules)
1769-IQ6XOW4	4	24V dc	5...265V ac 5...125V dc	0 mA	2.5 A	8.0 A	105 mA	50 mA	8 modules
1769-OW8	8	24V dc	5...265V ac 5...125V dc	0 mA	0.5 A @ 60°C(140°F) 1.0 A @ 30°C(86°F)	16 A	125 mA	100 mA	8 modules
1769-OW8I	8 individually isolated	24V dc	5...265V ac 5...125V dc	0 mA	0.5 A @ 60°C(140°F) 1.0 A @ 30°C(86°F)	16 A	125 mA	100 mA	8 modules
1769-OW16	16	24V dc	5...265V ac 5...125V dc	0 mA	2.5 A	20 A	205 mA	180 mA	8 modules

These ratings apply to the digital contact output modules.

Volts, Max.	Continuous Amps per Point	Amperes		Voltamperes		IEC 947	NEMA ICS 2-125
		Make	Break	Make	Break		
240V ac	2.5A	7.5A	0.75A	1800VA	180VA	AC15✶	C300
120V ac		15A	1.5A				
125V dc	1.0A	0.22A		28VA		DC13✶	R150
24V dc	2.0A	1.2A		28VA		—	—

✶Does not apply to the 1769-OW16 module.

Analog I/O Modules

Choose analog, thermocouple, or RTD modules when you need:

- Individually configurable channels
- On-board scaling
- Autocalibration of inputs
- On-line configuration
- Selectable input filters
- Over-range and under-range detection and indication
- Selectable response to a broken input sensor
- Selectable power source
- Input modules offer both single-ended or differential inputs
- High accuracy ratings

1769 Compact analog modules

Cat. No.	Number of Inputs	Number of Outputs	Resolution, Bits	Signal Range	Sensors Supported	Backplane Current (mA) at 5V	Backplane Current (mA) at 24V	Power Supply Distance Rating (modules)
1769-IF4	4	—	14 bits (unipolar)	0…20 mA 4…20 mA 0…10V dc ±10V dc 0…5V dc 1…5V dc	—	105 mA	60 mA†	8 modules
1769-IF8	8	—	16 bits (unipolar)	0…20 mA 4…20 mA 0…10V dc ±10V dc 0…5V dc 1…5V dc	—	120 mA	70 mA	8 modules
1769-OF2	—	2	—	—	—	120 mA	120 mA†	8modules modules
1769-OF8C	—	8 current	16 bits (unipolar)	0…20 mA 4…20 mA 0…10V dc ±10V dc 0…5V dc 1…5V dc	—	145 mA	160 mA	8 modules
1769-OF8V	—	8 voltage	16 bits (unipolar)	0…20 mA 4…20 mA	—	145 mA	125 mA	8 modules
1769-IF4XOF2	4	2 individually isolated	8 bits plus sign‡ individually isolated	0…10V dc ±10V dc 0…5V dc 1…5V dc	—	120 mA	160 mA	8 modules
1769-IR6	6	—	Input filter and configuration dependent	—	100, 200, 500, 1000 Ω Platinum, alpha=385 100, 200, 500, 1000 Ω Platinum, alpha=3916 120 Ω Nickel, alpha=672 120 Ω Nickel, alpha=618 10 Ω Copper 604 Ω Nickel-Iron 518 0…150 Ω 0…500 Ω 0…1000 Ω 0…3000 Ω	100 mA	45 mA	8 modules
1769-IT6	6, plus 2 cold junction sensors	—	—	—	Thermocouple types: J, K, T, E, R, S, B, N, C ±50mV ±100mV	100 mA	40 mA	8 modules

1769-HSC High-Speed Counter Module

Use the 1769-HSC when you need:

- a counter module that is capable of reacting to high-speed input signals.
- to generate rate and time-between-pulses (pulse interval) data
- as many as 2 channels of quadrature or 4 channels of pulse/count inputs

Cat. No.	Number of Inputs	Number of Outputs	Backplane Current (mA) at 5V	External Power	Power Supply Distance Rating (modules)
1769-HSC	2	4	425 mA	19.2...31.2V dc 100 mA @ 24V dc	4 modules

1769-SM1 Compact I/O to DPI/SCANport Module

The 1769-SM1 module provides a direct 1769 platform connection for PowerFlex 7-Class drives, other DPI-based Host devices, and SCANport-based Host devices such as 1305 and 1336 PLUS II drives. Three channels support any combination of as many as three DPI and/or SCANport Host devices to be connected per module. The 1769-SM1 can be used with the MicroLogix 1500, CompactLogix, and remote 1769-based nodes such as the 1769-ADN DeviceNet adapter.

Cat. No.	Number of Channels	Communication Rate	Backplane Current (mA) at 5V	Backplane Current (mA) at 24V	Power Supply Distance Rating (modules)
1769-SM1	3 any combination of DPI or SCANport	DPI or SCANport 125 Kbps or 500 Kbps	280 mA	60 mA per channel supplied by the DPI/SCANport host	6 modules

Communication Modules

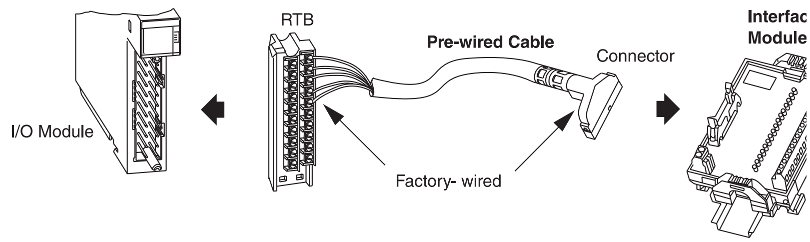
For DeviceNet connectivity, you can select from these communication modules:

Cat. No.	Communication Rate	Cable	Power Requirements, Max.	Power Consumption (W) at 24V	Backplane Current (mA) at 5V	Power Supply Distance Rating
1769-SDN scanner	• 125 Kbps • 250 Kbps • 500 Kbps	Allen-Bradley part number 1485C-P1-Cxxx	90 mA @ 11V dc 110 mA @ 25V dc	2.2	440 mA	4 modules
1769-ADN adapter			90 mA	2.5	450 mA	8 modules

1492 Wiring Systems

As an alternative to buying RTBs and connecting the wires yourself, you can buy a wiring system of:

- interface modules (IFMs) that mount on DIN rails provide the output terminal blocks for the I/O module. Use the IFMs with the pre-wired cables that match the I/O module to the interface module.
- I/O-module-ready cables. One end of the cable assembly is an RTB that plugs into the front of the I/O module. The other end has individually color-coded conductors that connect to a standard terminal block.



Feed through IFMs for 1769 digital I/O modules

Cat. No.	Description	IA8I	IA16	IM12	IQ16	OA8	OB16	OV	OW8	OW8I
1492-IFM20F	standard	F69	A69	G69	B69	C69	E69	E69	C69	D69
1492-IFM20FN	narrow standard	F69	A69		B69	C69	E69	E69	C69	
1492-IFM20F-2	extra terminals		A69	G69	B69	C69	E69	E69	C69	
1492-IFM20F-3	3-wire sensor type input devices		A69		B69					
1492-XIMF-2	feed through expander with eight feed-through channels✶						E69			

Find the column for the digital I/O module. Follow the column down to see what digital IFMs are compatible with the I/O module as indicated by a letter code. When you select the IFM, use the letter code from this chart to find the compatible cable in the following table for digital pre-wired cabled. The letter code must match the last character of the catalog number for the cable.
✶Connect one expander module to a master to provide a total of 16 outputs. An extender cable is included with each expander to connect it to the master.

LED indicating IFMs for 1769 digital I/O modules

Cat. No.	Description	IA8I	IA16	IM12	IQ16	OA8	OB16	OV	OW8	OW8I
1492-IFM20D24	standard with 24V ac/dc LEDs				B69		E69	E69		
1492-IFM20D24N	narrow standard with 24V ac/dc LEDs				B69		E69			
1492-IFM20D120	standard with 120V ac LEDs		A69							
1492-IFM20D120N	narrow standard with 120V ac LEDs		A69							
1492-IFM20D24-2	24V ac/dc LEDs and extra terminals for outputs						E69	E69		
1492-IFM20D24A-2	24V ac/dc LEDs and extra terminals for inputs				B69					
1492-IFM20D120A-2	120V ac LEDs and extra terminals for inputs		A69							
1492-IFM20D24-3	3-wire sensor with 24V ac/dc LEDs				B69					
1492-IFM20DS24-4	isolated with 24/48V ac/dc LEDs and 4 terminals for outputs								C69	D69
1492-IFM20DS120-4	isolated with 120V ac LEDs and 4 terminals for outputs					C69			C69	D69
1492-IFM20D240-2	240V ac LEDs and extra terminals for inputs			G69						

Find the column for the digital I/O module. Follow the column down to see what digital IFMs are compatible with the I/O module as indicated by a letter code. When you select the IFM, use the letter code from this chart to find

Fusible IFMs for 1769 digital I/O modules

Cat. No.	Description	IA8I	IA16	IM12	IQ16	OA8	OB16	OV	OW8	OW8I
1492-IFM20F-F-2	extra terminals for outputs						E69	E69		
1492-IFM20F-F24-2	extra terminals with 24V ac/dc blown fuse indicators						E69	E69		
1492-IFM20F-F24A-2	extra terminals with 24V ac/dc blown fuse indicators				B69✶		E69			
1492-IFM20F-F120A-2	extra terminals with 120V ac/dc blown fuse indicators		A69							
1492-IFM20F-FS-2	isolated with extra terminals for outputs					C69			C69	D69
1492-IFM20F-FS24-2	isolated with extra terminals and 24V ac/dc blown fuse indicators								C69	D69
1492-IFM20F-FS120-2	isolated with extra terminals with 120V ac blown fuse indicators					C69			C69	D69
1492-IFM20F-FS120-4	isolated with 4 terminals with 120V ac blown fuse indicators					C69			C69	D69
1492-IFM20F-FS240-4	isolated with 4 terminals with 240V ac blown fuse indicators									D69
1492-XIMF-F24-2	fusible expander with eight 24V dc channels with blown fuse indicators†						E69			

Find the column for the digital I/O module. Follow the column down to see what digital IFMs are compatible with the I/O module as indicated by a letter code. When you select the IFM, use the letter code from this chart to find

✶Sink mode only.
†Connect one expander module to a master to provide a total of 16 outputs. An extender cable is included with each expander to connect it to the master.

Relay IFMs for 1769 digital I/O modules

Cat. No.	Description	IA8I	IA16	IM12	IQ16	OA8	OB16	OV	OW8	OW8I
1492-XIM2024-8R	20-pin master with eight 24V dc relays						E69			
1492-XIM24-8R	relay expander with eight 24V dc relays✶						E69			

Find the column for the digital I/O module. Follow the column down to see what digital IFMs are compatible with the I/O module as indicated by a letter code. When you select the IFM, use the letter code from this chart to find

✶Connect one expander module to a master to provide a total of 16 outputs. An extender cable is included with each expander to connect it to the master.

Pre-wired cables for digital I/O modules

Cat. No.✶	Number of Conductors	Conductor Size	Nominal Outer Diameter	RTB at the I/O Module End
1492-CABxA69	20	22 AWG	9.0 mm (0.36 in)	1769-RTBN18
1492-CABxB69	20	22 AWG	9.0 mm (0.36 in)	1769-RTBN18
1492-CAExC69	20	22 AWG	9.0 mm (0.36 in)	1769-RTBN10
1492-CAExD69	20	22 AWG	9.0 mm (0.36 in)	1769-RTBN18
1492-CAExE69	20	22 AWG	9.0 mm (0.36 in)	1769-RTBN18
1492-CAExF69	20	22 AWG	9.0 mm (0.36 in)	1769-RTBN18
1492-CAExG69	20	22 AWG	9.0 mm (0.36 in)	1769-RTBN18

✶Cables are available in lengths of 0.5m, 1.0m, 2.5m, and 5.0m. To order, insert the code for the desired cable length into the catalog number in place of the x: 005=0.5m, 010=1.0m, 025=2.5m, 050=5m.

I/O-module-ready cables for digital I/O modules

Cat. No.✶	Number of Conductors	Conductor Size	Nominal Outer Diameter	RTB at the I/O Module End
1492-CABxRTN10	20†	18 AWG	11.4 mm (0.45 in)	1769-RTBN10
1492-CABxRTN18	20‡	18 AWG	11.4 mm (0.45 in)	1769-RTBN18

✶Cables are available in lengths of 1.0m, 2.5m, and 5.0m. To order, insert the code for the desired cable length into the catalog number in place of the x: 010=1.0m, 025=2.5m, 050=5m. Build-to-order cable lengths are also available.
†Ten conductors are not connected to the RTB.
‡Two conductors are not connected to the RTB.

For example, a 1769-OB16 with LEDs and extra terminals uses:
- 1492-IFM20D24-2 interface module
- 1492-ACABxE69 cable (replace x with the appropriate length)

AIFMs for 1769 analog I/O modules

Cat. No.	Type of AIFM	Description	IF4 (single-end voltage)	IF4 (single-end current)	IF4 (differential voltage)	IF4 (differential current)	OF2 (voltage)	OF2 (current)
1492-AIFM4-3	feed through	4 channels with 3 terminals/channel	AA69	AB69	BA69	BB69	BC69	BD69

Find the column for the analog I/O module. Follow the column own to see what AIFMs are compatible with the I/O module as indicated by a letter code. When you select the AIFM, use the letter code from this chart to find the

Pre-wired cables for analog I/O modules

Cat. No.✶	Number of Conductors†	Conductor Size	Nominal Outer Diameter	RTB at the I/O Module End
1492-ACABxAA69	5 twisted pairs	22 AWG	7.44 mm (0.293 in)	1769-RTBN10
1492-ACABxAB69	5 twisted pairs	22 AWG	7.44 mm (0.293 in)	1769-RTBN10
1492-ACABxBA69	5 twisted pairs	22 AWG	7.44 mm (0.293 in)	1769-RTBN18
1492-ACABxBB69	5 twisted pairs	22 AWG	7.44 mm (0.293 in)	1769-RTBN18
1492-ACABxBC69	5 twisted pairs	22 AWG	7.44 mm (0.293 in)	1769-RTBN18
1492-ACABxBD69	5 twisted pairs	22 AWG	7.44 mm (0.293 in)	1769-RTBN18

✶Cables are available in lengths of 0.5m, 1.0m, 2.5m, and 5.0m. To order, insert the code for the desired cable length into the catalog number in place of the x: 005=0.5m, 010=1.0m, 025=2.5m, 050=5m. Build-to-order cable lengths are also available.

†Each cable for analog I/O has an overall shield with a ring lug on a 200mm (8.87 in) exposed drain wire at the I/O module end of the cable.

For example, a 1769-IF4 in single-end voltage mode uses:

- 1492-AIFM4-3 interface module
- 1492-ACABxBA69 cable (replace x with the appropriate length)

1492 PanelConnect Modules for Connecting Sensors

A PanelConnect module and its sensor connection systems lets you connect as many as 16 sensors directly to 16-point input modules using convenient pre-built cables and connectors.

The PanelConnect module mounts on the enclosure and creates the correct seal for the entry of the sensor connections. You do not need to seal the opening where the sensor cables enter the enclosure, create custom connectors, or wire to those custom connectors.

Cat. No.	System Voltage	Connects to These Distribution Boxes	Connector Style	Connectors	LEDs
1492-TPMA1008	ac	Allen-Bradley, Brad Harrison (Daniel Woodhead), Crouse-Hinds, and Lumberg	mini-plus (1 1/8 in.)	10 pin	without
1492-TPMA1207		Allen-Bradley, Brad Harrison (Daniel Woodhead), Crouse-Hinds, and Lumberg		12 pin	with
1492-TPMA2209		Turck	metric M23	12 pin	either with or without
1492-TPMD1004	dc	Allen-Bradley, Brad Harrison (Daniel Woodhead), and Crouse-Hinds	mini-plus (1 1/8 in.)	10 pin	without
1492-TPMD1201		Allen-Bradley		12 pin	with
1492-TPMD1202		Brad Harrison (Daniel Woodhead)		12 pin	with
1492-TPMD1203		Lumberg		12 pin	with
1492-TPMD2205		Turck	metric M23	12 pin	either with or without
1492-TPMD2206		Turck		12 pin	either with or without

You can select these PanelConnect modules and cables, depending on the 16-point input modules in your system:

I/O Module ✶	1492-TPMA1008	1492-TPMA1207	1492-TPMA2209	1492-TPMD1004	1492-TPMD1201	1492-TPMD1202	1492-TPMD1203	1492-TPMD2205	1492-TPMD2206
1769-IA16	1492-CABxA69	1492-CABxA69	1492-CABxA69	na	na	na	na	na	na
1769-IQ16	na	na	na	1492-CABxB69	1492-CABxB69	1492-CABxB69	1492-CABxB69	1492-CABxB69	1492-CABxB69

✶Cables are available in lengths of 0.5m, 1.0m, and 5.0m. To order, insert the code for the desired cable length into the catalog number in place of the x: 005=0.5m, 010=1.0m, 050=5m.

Select a patchcord to connect the PanelConnect module to the sensor distribution box, depending on the type of connector:

Cat. No.✶	Diameter - mm (in)	Wire Rating	Connector Type
889N-F10AFNU-x	17 (0.67)	16 AWG 600V 7A	10 pin Mini-Plus (1 18”), straight male
889N-F12AFNU-x	18 (0.71)		12 pin Mini-Plus (1 18”), straight male
889N-F10AFNV-x	17 (0.67)		10 pin Mini-Plus (1 18”), right-angle male
889N-F12AFNV-x	18 (0.71)		12 pin Mini-Plus (1 18”), right-angle male
889N-F10ACNU-x	9 (0.36)	18/22 AWG 300V 3A	10 pin Mini-Plus (1 18”), straight male
889N-F12ACNU-x	9 (0.36)		12 pin Mini-Plus (1 18”), straight male
889N-F10ACNV-x	9 (0.36)		10 pin Mini-Plus (1 18”), right-angle male
889N-F12ACNV-x	9 (0.36)		12 pin Mini-Plus (1 18”), right-angle male

✶Cables are available in lengths of 2m, 3m, 5m, and 10m. To order, insert the code for the desired cable length into the catalog number in place of the x: 2=2m, 3=3m, 5=5m, 10=10m.

Placing Compact I/O Modules in a CompactLogix System

You can DIN-rail or panel-mount the controller and I/O modules. The number of local I/O modules supported depends on the controller.

This controller:	Supports:	That can be separated into:
1769-L35E	30 local modules	3 separate banks
1769-L32E 1769-L31 1769-L30	16 local modules	3 separate banks
1769-L20	8 local modules	2 separate banks

If you separate the modules into multiple banks:

- the controller must be in the leftmost position of the first bank
- each bank needs its own power supply
- use expansion cables to connect the banks
- the last I/O bank requires an end cap

Selecting expansion cables

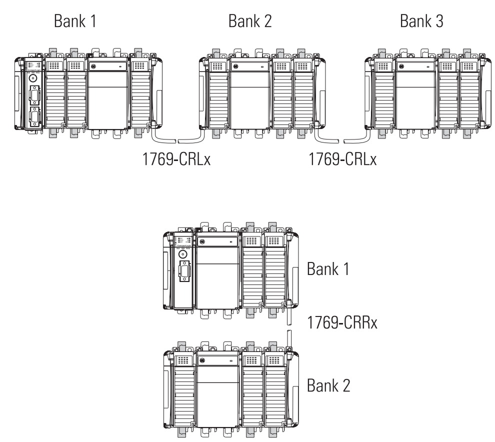
How you orient I/O banks determines which expansion cables you need to connect the I/O banks:

If you add a:	And connect the chassis from:	Use this cable:✶
second bank	right to left	1769-CRLx
	right to right	1769-CRRx
third bank	right to left	1769-CRLx
	right to right	1769CRRx
	left to left	1769-CLLx

✶Where x = 1 for 1 ft. (305 mm) or 3 for 3.28 ft. (1 m)

Horizontal Orientation

Vertical Orientation



Adding end caps

The controller is the leftmost module in the CompactLogix system. The controller has built-in termination, so the leftmost end of the system is terminated.

The final I/O bank in the CompactLogix system needs an end cap on the end without the expansion cable.

For a:	Order:
right end cap	1769-ECR
left end cap	1769-ECL

Selecting local or remote (distributed) I/O

In addition to local I/O, the CompactLogix controller can control remote (distributed) I/O via:

- EtherNet/IP using a 1769-L32E or 1769-L35E controller
- DeviceNet using a 1769-SDN scanner module

While local I/O can be lower cost and easier to configure, configuring remote I/O offers:

- more versatility in laying out your system
- more communication options, such as DeviceNet and EtherNet/IP
- ability to configure the listen only communication format for remote I/O modules

Validating I/O layout for 1769-L3xx controllers

The 1769-L3xx controller supports as many as 30 local modules which can be any combination of digital, analog, and specialty modules.

- Each module in a CompactLogix system uses a set amount of backplane memory, in addition to the data that the module stores or transfers. As you add modules, the minimum backplane RPI increases.
- To validate your system, the total 5V dc current and 24V dc current consumed must be considered. The I/O modules must be distributed such that the current consumed from the left or right side of the power supply never exceeds 2.0A at 5V dc and 1.0A at 24V dc.

As you install modules, the minimum backplane RPI increases. The RPI (request packet interval) defines the frequency at which the controller sends and receives all I/O data on the backplane. There is one RPI for the entire 1769 backplane. Consider these guidelines when installing modules:

Type of Module:	Considerations:
digital and analog (any mix)	• 1-4 modules can be scanned in 1.0 ms • 5-16 modules can be scanned in 1.5 ms • 17-30 modules can be scanned in 2.0 ms • some input modules have a fixed 8.0 ms filter, so selecting a faster RPI has no affect
specialty	• "full-sized" 1769-SDN modules add 1.5 ms per module • 1769-HSC modules add 0.5 ms per module

You can always select an RPI that is slower than listed above. These considerations show how fast modules can be scanned - not how fast an application can use the data. The RPI is asynchronous to the program scan. Other factors, such as program execution duration, affect I/O throughput.

Validating I/O layout for 1769-L20, -L30 controllers

To verify whether a 1769-L20, -L30 controller can support a planned I/O layout, consider:

- Each module in a CompactLogix system uses a set amount of backplane memory, in addition to the data that the module stores or transfers. Some modules require a considerable amount of backplane memory. Take this into account when designing your system because it affects how many modules a 1769-L20, -L30 controller can support.

  The 1769-L20, -L30 controllers support 256, 16-bit words of backplane data.

  Important: With some module combinations, especially those using modules that require larger amounts of backplane memory, you can exceed the amount of available backplane memory before reaching the maximum module count for the 1769-L20, -L30 controller.

  See the worksheet at the end of this document to calculate backplane memory use.
- To validate your system, the total 5V dc current and 24V dc current consumed must be considered. The I/O modules must be distributed such that the current consumed from the left or right side of the power supply never exceeds 2.0A at 5V dc and 1.0A at 24V dc.

How Compact I/O Modules Operate

The CompactLogix system follows a producer/consumer model. Input modules produce data for the system. Controllers, output modules, and specialty modules produce and consume data. The producer/consumer model multicasts data. This means that multiple nodes can consume the same data at the same time from a single device.

The controller continually scans the control logic. One scan is the time it takes the controller to execute the logic once. Input data transfers to the controller and output data transfers to output modules asynchronous to the logic scan.

All I/O modules in a CompactLogix system are scanned asynchronous to the program scan at a configurable RPI rate. You configure one RPI rate for all the local I/O in all the banks:

- 1 ms...750 ms for 1769-L3xx controllers
- 2 ms...750 ms for 1769-L20, -L30 controllers

Important: CompactLogix does not support Removal and Insertion Under power (RIUP). While the CompactLogix system is under power, any break in the connection between the power supply and the processor (i.e. removing the power supply, processor, or an I/O module) will clear processor memory (including the user program).

Selecting Controller Ownership

In a Logix system, modules multicast data. This means that multiple devices can receive the same data at the same time from a single device. When you choose a communication format for an I/O module, you have to choose whether to establish an owner or listen-only relationship with the module.

Relationship	Description
owner controller	The controller that creates the primary configuration and communication connection to a module. The owner controller writes configuration data and can establish a connection to the module.
listen-only connection	An I/O connection where another controller owns/provides the configuration data for the I/O module. A controller using a listen-only connection only monitors the module. It does not write configuration data and can only maintain a connection to the I/O module when the owner controller is actively controlling the I/O module.

Because of the distributed nature of a CompactLogix system, the CompactLogix controller must own its local I/O modules. No other Logix controller can listen to or own the local Compact I/O. The CompactLogix controller must produce its local I/O data for any other controller to consume. The listen-only format only works for remote I/O.

Step 2 - Select:

- *networks*
- *communication interfaces*
- *associated cable(s) and network equipment*

Selecting Network Communications

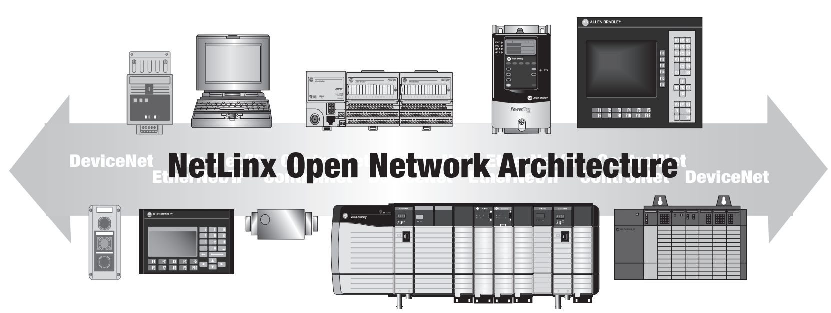
You use separate interface modules to connect to different networks.

- The 1769-L32E and 1769-L35E controllers each have a built-in, high-performance EtherNet/IP port and a built-in serial port.
- The 1769-L31 and 1769-L30 controllers each have two built-in RS-232 ports.
- The 1769-L20 controller has one built-in serial port.

NetLinx Open Network Architecture

NetLinx Open Network Architecture is the Rockwell Automation strategy of using open networking technology for seamless, top-floor to shop-floor integration. The networks in the NetLinx architecture – DeviceNet, ControlNet, and EtherNet/IP – speak a common language and share a universal set of communication services. NetLinx architecture, part of the Integrated Architecture, seamlessly integrates all the components in an automation system from a few devices on one network to multiple devices on multiple networks including access to the Internet – helping you to improve flexibility, reduce installation costs, and increase productivity.

- EtherNet/IP is an open industrial networking standard that supports implicit and explicit messaging and uses commercial, off-the-shelf Ethernet equipment and physical media.
- ControlNet allows intelligent, high-speed control devices to share the information required for supervisory control, work-cell coordination, operator interface, remote device configuration, programming, and troubleshooting.
- DeviceNet offers high-speed access to plant-floor data from a broad range of plant-floor devices and a significant reduction in wiring.



Selecting a network

You can configure your system for information exchange between a range of devices and computing platforms and operating systems. Select a CompactLogix controller with integrated communications or the appropriate communication device for the networks that meet your needs:

If your application requires:	Use this network:	Select:
• plant management • configuration, data collection, and control on a single, high-speed network • time-critical applications with no established schedule • data sent regularly • Internet/Intranet connection	EtherNet/IP network	1769-L32E, -L35E controller 1769-L31, -L30, -L20 controller with 1761-NET-ENI
• connections of low-level devices directly to plant floor controllers, without interfacing them through I/O modules • data sent as needed • more diagnostics for improved data collection and fault detection • less wiring and reduced start-up time than a traditional, hard-wired system	DeviceNet network	1769-SDN scanner 1761-NET-DNI interface 1769-ADN adapter
• modems • supervisory control and data acquisition (SCADA)	serial network	built-in serial port
• connections to existing DH-485 networks	DH-485 network	built-in serial port with a 1761-NET-AIC

EtherNet/IP Network

Ethernet Industrial Protocol (EtherNet/IP) is an open industrial networking standard that supports both real-time I/O messaging and message exchange. It emerged due to the high demand for using the Ethernet network for control applications. EtherNet/IP uses off-the-shelf Ethernet communication chips and physical media. Because Ethernet technology has been used since the mid 1970s and is widely accepted throughout the world, Ethernet products serve a large community of vendors.

EtherNet/IP product capability

	Recipient								
	EtherNet/IP PLC-5 or SLC 5/05 processor	**PLC-5 processor via 1785-ENET**	**Logix controller✶**	**1756-ENBT module✶**	**1794-AENT FLEX I/O adapter**	**1734-AENT POINT I/O adapter**	**PanelView EtherNet/IP terminal**	**RSLinx software**	**CompactLogix controller with 1761-NET-ENI interface**
EtherNet/IP PLC-5 or SLC 5/05 processor	information	information	information	na	not supported	not supported	information	information	information
PLC-5 processor via 1785-ENET	information	information	information	na	not supported	not supported	information	information	information
Logix controller✶	information	information	information I/O data interlocking	I/O data	I/O data	I/O data	information I/O data	information	information
PanelView EtherNet/IP terminal	information	information	information I/O data	na	na	na	na	na	information
RSLinx software	information	information	information	na	not supported	not supported	na	information	information
CompactLogix controller with 1761-NET-ENI interface†	information	information	information	na	not supported	not supported	information	information	information

✶ For EtherNet/IP control:
- a ControlLogix controller requires a 1756-ENBT or 1756-ENET series B module
- a FlexLogix controller requires a 1788-ENBT card
- a CompactLogix controller must be a 1769-L32E or 1769-L35E controller
- the PC for a SoftLogix5800 controller requires appropriate hardware for Ethernet communications

†To be an originator, the 1761-NET-ENI interface must connect to the other device through that device's RS-232 port.

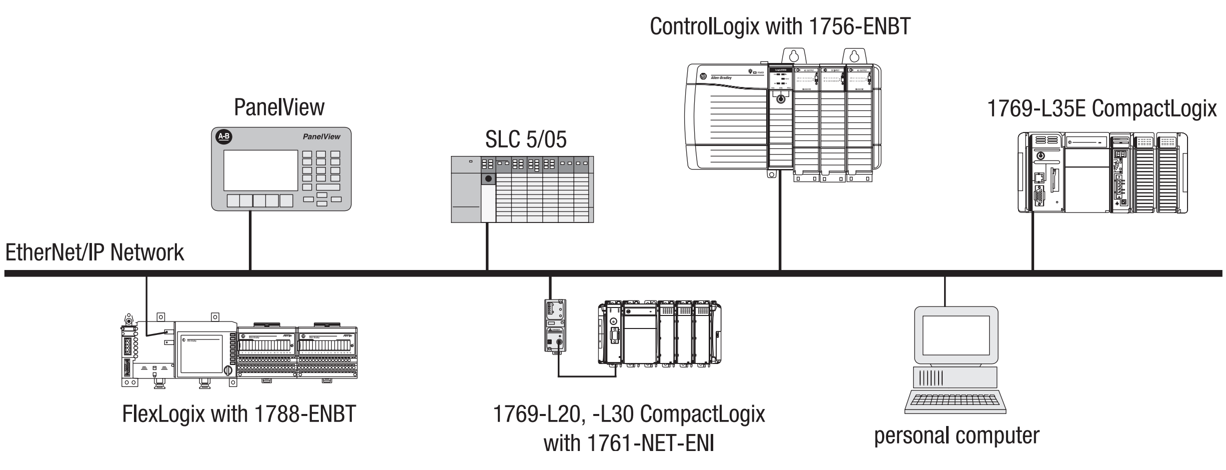
Selecting an EtherNet/IP interface

Select the appropriate controller and EtherNet/IP interface depending on the application and how the controller interacts with the devices:

If your application:	Select this controller and interface:	Description:
• controls I/O over EtherNet/IP • produces and consumes data over EtherNet/IP • accesses both EtherNet/IP and serial devices • requires high performance over EtherNet/IP	1769-L32E or 1769-L35E CompactLogix controller with integrated EtherNet/IP port	The 1769-L32E and 1769-L35E CompactLogix controller has one built-in EtherNet/IP port and one built-in RS-232 port. The controller can control local I/O in addition to I/O remotely connected via EtherNet/IP. The controller supports as many as 32 remote EtherNet/IP connections.
• sends and receives messages over EtherNet/IP • transfers small amounts of data over EtherNet/IP • trades lower cost for lower performance than the 1769-L35E	1769-L31, -L30, -L20 controller with 1761-NET-ENI interface, series B	The 1761-NET-ENI series B interface module routes a DF1 message received from the attached controller to a compatible destination TCP/IP device. This is accomplished by using DF1 node addresses 0 through 49. The 1761-NET-ENI node addresses 100 through 149 store TCP/IP destination addresses. When the 1761-NET-ENI receives a write message to nodes 100 to 149, it stores the TCP/IP destination address in the corresponding map register.

Cat. No.	Communication Rate	Connections	Connector	Power Requirements, Max.	Current Draw
1769-L32E	10/100 Mbps	Each controller supports a maximum of: • 64 TCP/IP connections • 32 Logix connections (I/O and information) • 5000 messages/second	RJ-45	5...24V dc	xxx mA @ 5 V dc xx mA @ 24 V dc
1769-L35E	10/100 Mbps			5...24V dc	660 mA @ 5 V dc 90 mA @ 24 V dc
1761-NET-ENI	10 Mbps✶	Each device supports a maximum of: • 6 TCP/IP connections		20.4...26.4V dc	50 mA typical 100 mA maximum

Certifications: UL, CSA (Class I, Division 2, Group A, B, C, D), CE
✶The 1761-NET-ENI is an Ethernet to serial linking device. While 10 Mbps is the fastest communication rate supported by a 1761-NET-ENI device, the actual network performance depends on the maximum serial port connection speed.



DeviceNet Network

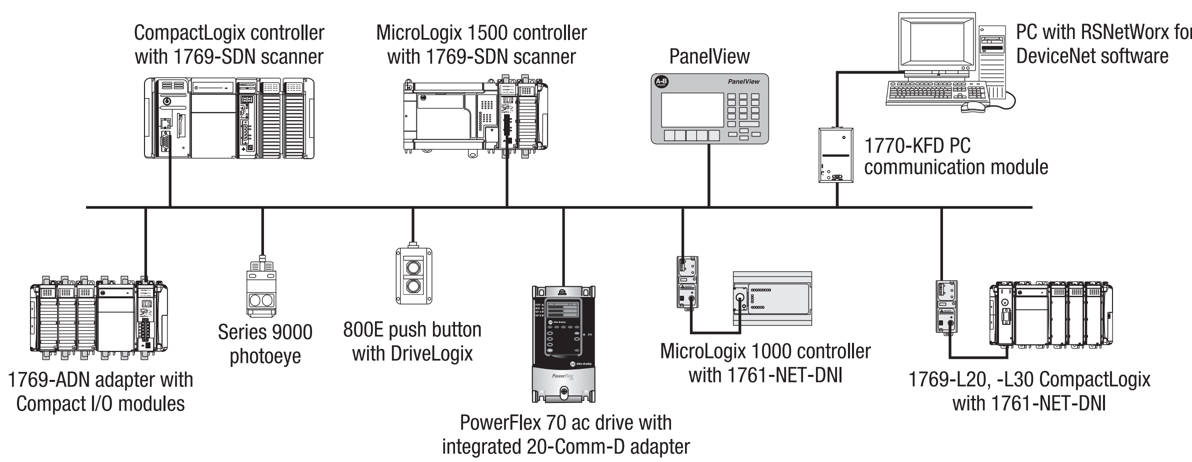
The DeviceNet network is an open low-level network that provides connections between simple industrial devices (such as sensors and actuators) and higher-level devices (such as PLC controllers and computers). The DeviceNet network uses the proven Common Industrial Protocol (CIP) to provide the control, configure, and data collection capabilities for industrial devices. The DeviceNet network is a flexible network that works with devices from multiple vendors.

If your application does this:	Select this interface:	Description:
• communicates with other DeviceNet devices (I/O and messages) • requires explicit messaging • uses the controller as a master or slave on DeviceNet • uses the controller serial port for other communications • requires higher performance than available from the 1769-NET-DNI The 1769-L20, -L30 controller can only have one 1769-SDN module per controller. The 1769-L3xx controller does not have this limit.	1769-SDN DeviceNet scanner module	The scanner acts as an interface between DeviceNet devices and the CompactLogix controller. The scanner lets the controller: • read inputs from slave devices • write outputs to slave devices • send and receive messages between a 1769-L35xx controller and a DeviceNet device
• communicates with other DeviceNet devices (messaging only) • uses the controller only as a slave on DeviceNet • does not use the controller serial port for other communications • trades lower cost for lower performance than the 1769-SDN Connect the 1761-NET-DNI module to the CompactLogix controller to connect it to the DeviceNet network.	1761-NET-DNI interface	The interface module links the CompactLogix controller to other devices on a DeviceNet network to: • download configuration data to a device • monitor operational status of a device • communicate with peer devices (messaging) • upload/download programs
• accesses remote Compact I/O over a DeviceNet network • sends remote I/O data for as many as 30 modules back to scanner or controller Use the 1769-ADN adapter to connect Compact I/O systems to a DeviceNet network. The CompactLogix controller can communicate to these remote I/O modules through the 1769-ADN adapter.	1769-ADN DeviceNet adapter module	The adapter: • interfaces with as many as 30 Compact I/O modules • communicates to other network system components (typically a controller or scanner and/or programming terminals) over the DeviceNet network

Select the appropriate DeviceNet interface depending on the application and how the controller interacts with the devices:

Cat. No.	Communication Rate	Cable	Power Requirements, Max.	Power Consumption (W) at 24V	Backplane Current (mA) at 5V	Power Supply Distance Rating
1769-SDN	• 125 Kbps • 250 Kbps • 500 Kbps	Allen-Bradley part number 1485C-P1-Cxxx	90 mA @ 11V dc 110 mA @ 25V dc	2.2	440 mA	4 modules
1761-NET-DNI✶			11...25V dc	—	200 mA @ 24V dc 350 mA @ 11V dc	na
1769-ADN†			90 mA	2.5	450 mA	8 modules

Certifications: UL, CSA (Class I, Division 2, Group A, B, C, D), CE, FM, C-Tick
✶The 1761-NET-DNI is a DeviceNet to serial linking device. The actual network performance depends on the maximum serial port connection speed.
†The series A 1769-ADN adapter does not support the 1769-OA16, 1769-OW16, 1769-IF4XOF2, or 1769-HSC modules.



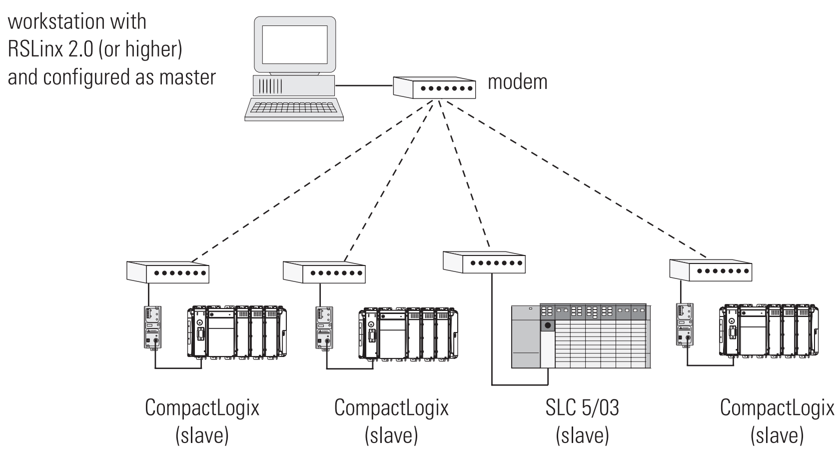
Serial Network

The serial port is compatible with RS-232 serial communication. The serial port supports the DF1 protocol to communicate with other devices on the serial link. You can select:

Use this DF1 mode:	For:
point to point	communication between a controller and other DF1-compatible devices using DF1 full-duplex protocol
DF1 master	control of polling and message transmission between the master and each slave using DF1 half-duplex polled protocol
DF1 slave	using the controller as a slave station in a master/slave serial network using DF1 half-duplex protocol
user mode (ASCII)	communication between a controller and an ASCII device, such as a bar code reader

The CompactLogix controller you choose determines the number of serial ports that are available:

If you need:	Identified as:	With this protocol:	Select this controller:
one serial port	channel 0 (fully isolated)	DF1, DH-485, ASCII	1769-L35E 1769-L32E
two serial ports	channel 0 (fully isolated) channel 1 (non-isolated)	channel 0: DF1, DH-485, ASCII channel 1: DF1, DH-485	1769-L31
two serial ports	channel 0 (non-isolated) channel 1 (fully-isolated)	channel 0: DF1, DH-485, ASCII channel 1: DF1, DH-485	1769-L30
one serial port	channel 0 (non-isolated)	DF1, DH-485, ASCII	1769-L20



If you connect the controller to the non-isolated port (channel 1) on the controller to a programming workstation, modem, or ASCII device, install an isolator between the controller and the end device. One possible isolator is the 1761-NET-AIC interface converter.

Modbus support

To use Logix5000 controllers on Modbus, you connect through the serial port and execute a specific ladder logic routine. The ladder logic routine is available on the CD for RSLogix 5000 Enterprise programming software. For more information, see *Using Logix5000 Controllers as Masters or Slaves on Modbus Application Solution*, publication CIG-AP129A-EN-P.

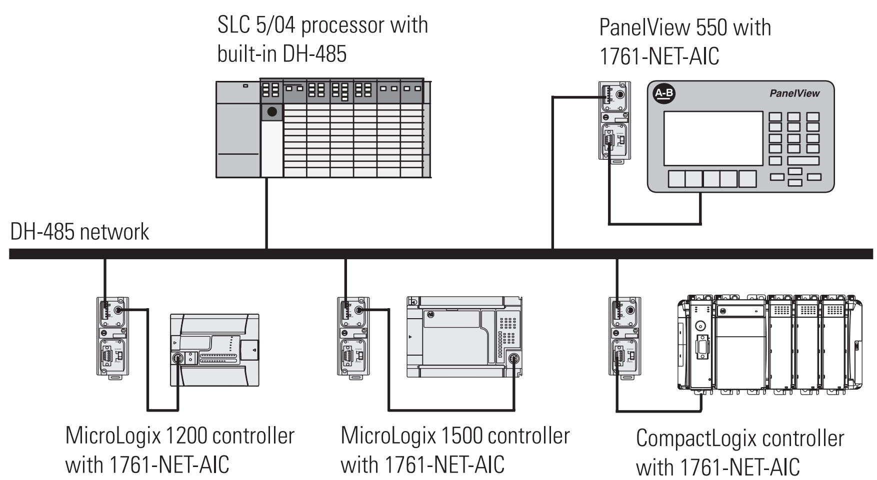
DH-485 Network

On the DH-485 network, the controller can send and receive messages to and from other controllers on the network. The DH-485 connection does support remote programming and monitoring via RSLogix 5000 software. However, excess traffic over a DH-485 connection can adversely affect overall performance and can lead to timeouts and loss in RSLogix 5000 configuration performance.

Important: Only use Logix controllers on DH-485 networks when you want to add controllers to an existing DH-485 network. For new applications with Logix controllers, networks in the NetLinx architecture are the recommended networks.

You need a 1761-NET-AIC+ converter for each controller you want to put on the DH-485 network. You can have two controllers per one 1761-NET-AIC+ converter, but you need a different cable for each controller. Connect one controller to port 1 (9-pin connector) and one controller to port 2 (mini-DIN connector).

If you connect to this port:	Use this cable:
port 1 DB-9 RS-232, DTE connection	1747-CP3 or 1761-CBL-AC00
port 2 mini-DIN 8 RS-232 connection	1761-CBL-AP00 or 1761-CBL-PM02



Step 3 - Select:
- *a controller with sufficient memory*
- *a controller with sufficient performance and capacity*
- *replacement batteries*
- *a CompactFlash card for a 1769-L3xx controller*

Selecting Controllers

CompactLogix controllers can monitor and control I/O across the 1769 CompactBus, as well as over remote I/O links. CompactLogix controllers can communicate with computers or other processors across RS-232-C (DF1/DH-485 protocol), DeviceNet, and EtherNet/IP networks. To provide communication for a CompactLogix controller, install the appropriate interface module or select a controller with integrated communications.

The multi-tasking operating system supports configurable tasks that can be prioritized. One task can be continuous. The others must be periodic or event tasks. Each task can have as many as 32 programs, each with its own local data and logic, allowing virtual machines to operate independently within the same controller.

Specification	Description
Power Supply Distance Rating	4 modules
Power Supply	1769-PA2 1769-PB2 1769-PA4 1769-PB4
Battery	1769-BA (all CompactLogix controllers) 1747-BA (1769-L30, -L20 only)
Supported Programming Languages	relay ladder function block diagram structured text sequential function chart
Programming Cable	1761-CBLPM02 to 1761-NET-AIC isolator 1761-CBLPA00 to 1761-NET-AIC isolator 1756-CP3 directly to controller 1747-CP3 directly to controller standard RJ-45 Ethernet cable (1769-L35E)

Certifications: UL, CSA (Class I, Division 2, Group A, B, C, D), CE, C-Tick

The 1769-L35E, -L32E, -L31 controllers offer significant performance and capacity improvements over the 1769-L20 and 1769-L30 controllers. These 1769-L3xx controllers are designed for mid-range applications. They offer:
- increased user memory up to 1.5 Mbytes
- CompactFlash for non-volatile memory storage
- extended I/O capacity up to 30 I/O modules
- increased backplane capacity and throughput resulting in the ability to mix and match any combination of digital, analog, and specialty I/O modules
- backplane messaging support
- EtherNet/IP support, including control of distributed I/O
- increased I/O performance allows 1ms backplane RPI under certain conditions

CompactLogix Controllers

Cat. No.	User Memory✶		Number of Tasks	Ports	Bus Current Draw	Power Dissipation	Maximum Number of I/O Modules	Power Supply Distance Rating
	Battery-Backed Static RAM	Nonvolatile Memory						
1769-L35E	1.5 Mbytes	64 Mbytes CompactFlash†	8 tasks	1 port EtherNet/IP 1 port RS-232	660 mA @ 5V dc 90 mA @ 24V dc	4.74 W	30 in a maximum of 3 banks	4 modules
1769-L32E	750 Kbytes	64 Mbytes CompactFlash†	6 tasks	1 port EtherNet/IP 1 port RS-232	660 mA @ 5V dc 90 mA @ 24V dc	4.74 W	16 in a maximum of 3 banks	4 modules
1769-L31	512 Kbytes	64 Mbytes CompactFlash†	4 tasks	1 port RS-232 (DF1 only) 1 port RS-232 (DF1 or ASCII)	330 mA @ 5V dc 40 mA @ 24V dc	2.61 W	16 in a maximum of 3 banks	4 modules
1769-L30	256 Kbytes	integrated 256 Kbytes	4 tasks	1 port RS-232 (DF1 only) 1 port RS-232 (DF1 or ASCII)	800 mA @ 5V dc 0 mA @ 24V dc	4 W	16 in a maximum of 3 banks	4 modules
1769-L20	64 Kbytes	integrated 64 Kbytes	4 tasks	1 port RS-232	600 mA @ 5V dc 0 mA @ 24V dc	3 W	8 in a maximum of 2 banks	4 modules

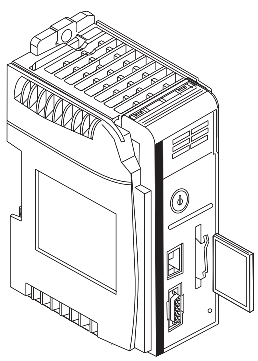
✶Available user memory is the amount of memory available to the user after RSLogix 5000 Enterprise Series software is connected and a null program is loaded.
†The CompactFlash card is available separately as 1784-CF64.

Estimating controller memory use

The following equations provide an estimate of the memory needed for a controller.

Controller tasks	_____ * 4000	=	_____ bytes (minimum 1 task)
Digital I/O points	_____ * 400	=	_____ bytes
Analog I/O points	_____ * 2600	=	_____ bytes
Motion axes	_____ * 8000	=	_____ bytes

Non-volatile memory



The nonvolatile memory (flash) lets you permanently store a user program and tag data on a controller. You can:

- manually trigger the controller to save to or load from nonvolatile memory
- configure the controller to load from nonvolatile memory on power up

The 1769-L31, -L32E, -L35E controllers support a removable CompactFlash card for nonvolatile memory. You install the 1784-CF64 card in the socket on the front of the controller. You can install and remove CompactFlash while the controller is installed and running.

Warning: When you insert or remove the card while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Controller Battery

The CompactLogix controller comes with one lithium battery:

This Controller	Uses This Battery
1769-L20 1769-L30	1769-BA 1747-BA
1769-L3xx	1769-BA

Controlling Devices

The CompactLogix controller can control these devices:

I/O Modules	1769-L32E, -L35E EtherNet/IP✶	DeviceNet†
1756 ControlLogix I/O	yes	yes
1794 FLEX I/O	yes	yes
1797 FLEX Ex I/O‡	yes	no
1734 POINT I/O	yes	yes
1734D POINT Block I/O	yes	yes
1769 Compact I/O	yes	yes
1790 Compact LDX I/O	no	yes
1791 Block I/O	no	no
1791D CompactBlock I/O	no	yes
1792 ArmorBlock I/O	no	yes
1798 FlexArmor I/O	no	yes
1799 Embedded I/O	no	yes
1747 SLC I/O	no	no
1771 I/O	no	no

✶A non-EtherNet/IP CompactLogix controller requires a 1761-NET-ENI interface to connect to an EtherNet/IP network. This interface is only a messaging bridge.
†To control I/O, use a 1769-SDN scanner to connect the controller to the DeviceNet network.
‡Insert a 1797-BIC and 1797-CEC module pair to isolate the FLEX Ex I/O modules from the non-intrinsically safe portion of the system.
§Use a 1771-ACN15, -ACNR15 adapter module. Version 10 and later of RSLogix 5000 Enterprise Series software supports 1771 digital, analog, and specialty I/O modules. Previous versions of the software support only 1771 digital I/O modules.

Display Devices	EtherNet/IP✶	DeviceNet†	RS-232 (DF1)	DH-485
2711P PanelView Plus terminal	yes	yes	yes	yes
6182H VersaView CE computer	yes	yes	yes	yes
2711 PanelView terminal	yes	yes	yes‡	yes‡
2711 e PanelView terminal	no	no	no	no
2705 RediSTATION/RediPANEL operator module	no	yes	no	no
2706 InView message display	yes	yes	yes	yes
2706 DL40 Dataliner message display	no	no	yes	no
2706 DL, DL50 DataLiner message display	no	no	yes	no
2707 DTAM Plus operator interface	no	yes	yes‡	yes‡

✶A non-EtherNet/IP CompactLogix controller requires a 1761-NET-ENI interface to connect to an EtherNet/IP network. This interface is only a messaging bridge.
†For DeviceNet access, use either a 1769-SDN scanner (control I/O and send/receive messages) or a 1761-NET-DNI interface (messaging bridge).
‡Use PLC/SLC mapping.

Communicating with Other Controllers and Communication Devices

The CompactLogix system takes advantage of several networks to allow communications with many different controllers and devices. The following table lists which products the CompactLogix controller can communicate with over which networks.

Controller	EtherNet/IP✶	DeviceNet†	RS-232 (DF1)	DH-485
1756 ControlLogix	yes	yes	yes	yes
1769 CompactLogix	yes	yes	yes	yes
1789 SoftLogix5800	yes	yes	yes	no
1794 FlexLogix	yes	yes	yes	yes
5720 PowerFlex 700S DriveLogix	yes	yes	yes	no
1785 PLC-5	yes‡§	yes♣	yes	na
1747 SLC	yes➤	yes♣	yes	no
1761 MicroLogix	yes	yes♣	yes	no
1762 MicroLogix	yes	yes♣	yes	no
1769 MicroLogix	yes	yes♣	yes	no
1772 PLC-2	na	na	yes⌘	na
1775 PLC-3	na	na	yes✦	na
5250 PLC-5/250	no	na	yes	na

✶A non-EtherNet/IP controller requires a 1761-NET-ENI interface to connect to an EtherNet/IP network. This interface is only a messaging bridge.
†For DeviceNet access, use either a 1769-SDN scanner (control I/O and send/receive messages) or a 1761-NET-DNI interface (messaging bridge).
‡The Ethernet PLC-5 processor must be one of these:
series C, revision N.1 or later
series D, revision E.1 or later
series E, revision D.1 or later
§The 1785-ENET Ethernet communication interface module must be series A, revision D or later.
♣The PLC-5, SLC, and MicroLogix processors appear as I/O points to the Logix controller. Requires 1761-NET-DNI DeviceNet interface.
➤Use a 1747-L55x controller with OS501 or greater.
⌘The PLC-2 controller requires a 1771-KG module for serial (DF1) communications.
✦The PLC-3 controller requires a 1775-KA module for serial (DF1) communications.

Communication Device	EtherNet/IP✶	DeviceNet†	RS-232 (DF1)	DH-485
9355 RSLinx software	yes	yes	yes	no
1784-KTC, -KTCx, -KTCx15, -PCIC(S), -PCC	na	na	na	na
1784-PCIDS, -PCD	na	yes	na	na
1788-CN2DN	na	yes	na	na
1788-EN2DN	yes	yes	na	na
1788-CN2FF	na	na	na	na
1203-CN1 ControlNet module‡	na	na	na	na
1203-FM1/FB1 SCANport§	na	na	na	na

✶A non-EtherNet/IP CompactLogix controller requires a 1761-NET-ENI interface to connect to an EtherNet/IP network. This interface is only a messaging bridge.
†For DeviceNet access, use either a 1769-SDN scanner (control I/O and send/receive messages) or a 1761-NET-DNI interface (messaging bridge).
‡Use the generic module configuration to configure the 1203-CN1 module and a CIP generic MSG instruction to communicate with the module.
§Use a CIP generic MSG instruction to communicate with the 1203-FM1 SCANport module on a DIN rail that is remote to the controller. The remote DIN rail also requires a 1794-ACN(R)15 ControlNet adapter module.

How a Logix System Uses Connections

A Logix system uses a connection to establish a communication link between two devices. Connections can be:

- controller to local I/O modules or local communication modules
- controller to remote I/O or remote communication modules
- controller to remote I/O (rack optimized) modules
- produced and consumed tags
- messages

You indirectly determine the number of connections the controller uses by configuring the controller to communicate with other devices in the system. Connections are allocations of resources that provide more reliable communications between devices than unconnected messages.

All EtherNet/IP connections are unscheduled. The 1769-L32E and 1769-L35E controllers each support 32 unscheduled connections.

Method	Description
unscheduled connection • deterministic • used by both ControlNet and EtherNet/IP	An unscheduled connection is a message transfer between controllers that is triggered by the requested packet interval (RPI) or the program (such as a MSG instruction). Unscheduled messaging lets you send and receive data when needed. All EtherNet/IP connections are unscheduled.
unconnected message • least deterministic	An unconnected message is a message that does not require connection resources. An unconnected message is sent as a single request/response.

Determining Connections for Produced and Consumed Tags

The controller supports the ability to produce (broadcast) and consume (receive) system-shared tags over an EtherNet/IP network. Produced and consumed tags each require connections.

This type of tag:	Requires these connections:
produced	A produced tag allows other controllers to consume the tag, which means that a controller can receive the tag data from another controller. The local controller (producing) uses one connection for the produced tag and one connection for each consumer. The controller's communication device uses one connection for each consumer. As you increase the number of controllers that can consume a produced tag, you also reduce the number of connections the controller and communication device have available for other operations, like communications and I/O.
consumed	Each consumed tag requires one connection for the controller that is consuming the tag. The controller's communication device uses one connection for each consumer.

For two controllers to share produced or consumed tags, both controllers must be attached to the same control network. You cannot bridge produced and consumed tags over two networks.

The total number of tags that can be produced or consumed is limited by the number of available connections. If the controller uses all of its connections for I/O and communication devices, no connections are left for produced and consumed tags.

Determining Connections for Messages

Messages transfer data to other devices, such as other controllers or operator interfaces. Some messages use unscheduled connections to send or receive data. These connected messages can leave the connection open (cache) or close the connection when the message is done transmitting. The following table shows which messages use a connection and whether or not you can cache the connection:

This type of message:	Using this communication method:	Uses a connection:
CIP data table read or write	CIP	✓
PLC2, PLC3, PLC5, or SLC (all types)	CIP	
	CIP with Source ID	
	DH+	✓
CIP generic	CIP	your option*
block-transfer read or write	na	✓

*You can connect CIP generic messages, but for most applications we recommend you leave CIP generic messages unconnected.

Connected messages are unscheduled connections on EtherNet/IP networks.

Each message uses one connection, regardless of how many devices are in the message path. To conserve connections, you can configure one message to read from or write to multiple devices.

If a message executes repeatedly, cache the connection. This keeps the connection open and optimizes execution time. Opening a connection each time the message executes increases execution time.

If a message executes infrequently, do not cache the connection. This closes the connection upon completion of the message, which frees up that connection for other uses.

Determining Connections for I/O Modules

A Logix system uses connections to transmit I/O data. These connections can be direct connections or rack-optimized connections.

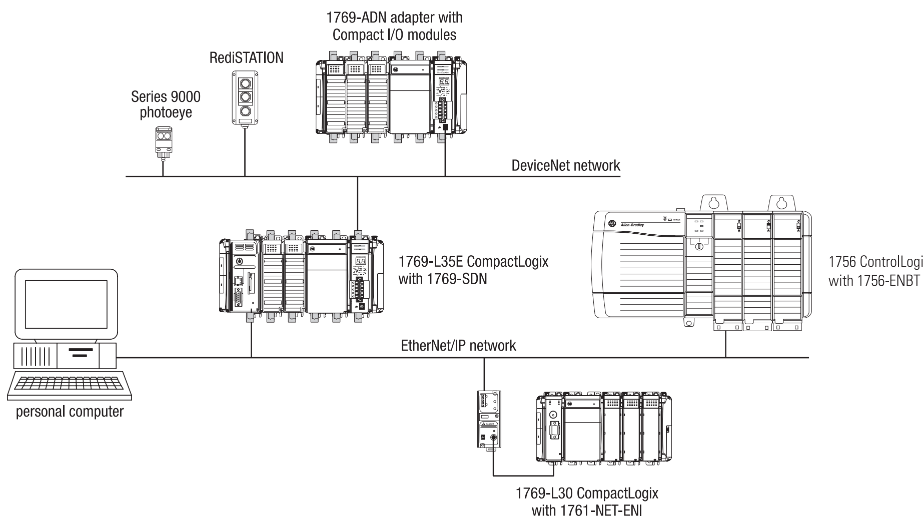
Connection	Description
direct	A direct connection is a real-time, data transfer link between the controller and an I/O module. The controller maintains and monitors the connection between the controller and the I/O module. Any break in the connection, such as a module fault or the removal of a module while under power, causes the controller to set fault status bits in the data area associated with the module. Typically, analog I/O modules and specialty modules require direct connections.
rack-optimized	For digital I/O modules, you can select rack optimized communication. A rack optimized connection consolidates connection usage between the controller and all the digital I/O modules on a rack (or DIN rail). Rather than having individual, direct connections for each I/O module, there is one connection for the entire rack (or DIN rail).

Connections Example

In this example system the 1769-L35E controller:

- controls remote I/O devices on DeviceNet
- controls remote FLEX I/O on EtherNet/IP
- sends and receives messages to/from the 1756 ControlLogix controller and the 1769-L30 controller over EtherNet/IP
- produces one tag that the the 1756 ControlLogix controller consumes
- is programmed via RSLogix 5000 programming software

The 1769-L35E controller in this example uses these connections:



Connection Type	Module Quantity	Connections per Module	Total Connections
controller to 1769-SDN	1	2✶	2
controller to remote FLEX communication adapter	1	1	1
controller to RSLogix 5000 programming software	1	1	1
message to 1756 ControlLogix controller	1	1	1
message to 1769-L30 controller	1	1	1
produced tag consumed by 1756 ControlLogix controller	1	1	1
total			7

✶The controller uses 2 connections for a 1769-SDN module - one for communications to the controller and one for data.

Determining Total Connection Requirements

The total connection requirements for a CompactLogix system include both local and remote connections. Tallying local controller connections is not an issue because the controller supports the maximum number of I/O modules. It is important to tally remote connections because the controller supports different amounts of connections over different networks.

Connection Type	Device Quantity	Connections per Device	Total Connections
remote EtherNet/IP communication module configured as a direct (none) connection configured as a rack-optimized connection		0 **or** 1	
remote I/O module over EtherNet/IP (direct connection)		1	
remote device over DeviceNet (accounted for in rack-optimized connection for local 1769-SDN module)		0	
produced tag		0	
each consumer		1	
consumed tag		1	
cached message		1	
total			

Step 4 - Select:

- *if power consumption exceeds the maximum for a single power supply, install additional banks and power supplies*

Selecting Power Supplies

Compact I/O power supplies distribute power from either side of the power supply. For example, a 2A at 5V dc power supply (1769-PA2, -PB2) can provide 1A to the right side of the power supply and 1A to the left. A 4A at 5V dc power supply (1769-PA4, -PB4) can provide 2A to the right side of the power supply and 2A to the left.

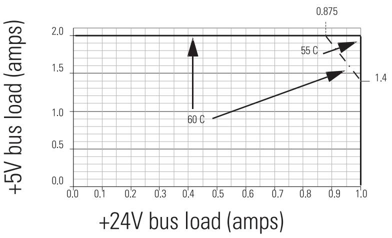
Specification	1769-PA2	1769-PB2	1769-PA4	1769-PB4
Nominal Input Voltage	120V ac or 240V ac	24V dc	120V ac or 240V ac	24V dc
Input Voltage Range	85...265V ac	19.2...31.2V dc	85...265V ac	19.2...32V dc
Maximum Line Requirement	100VA @ 120V ac 130VA @ 240V ac	50VA @ 24V dc	200VA @ 120V ac 240VA @ 240V ac	100VA @ 24V dc
Output Bus Current Capacity (0° to 55°C)	2 A @ 5V dc 0.8 A @ 24V dc		4 A @ 5V dc 2 A @ 24V dc	
24V dc User Power Capacity (0° to 55°C)	250 mA	na	na	na
Maximum Inrush	25A at 132V ac, 10Ω source impedance 40A at 265V ac, 10Ω source impedance	30A at 31.2V dc	25A at 132V ac, 10Ω source impedance 40A at 265V ac, 10Ω source impedance	30A at 31.2V dc
Line Loss Ride Through	10 ms (minimum) to 10s (maximum)		5 ms (minimum) to 10s (maximum)	
Minimum Load Current	0 mA at 5V dc; 0 mA at 24V dc			
Short Circuit Protection	Front Access Fuse (replacement part number: Wickmann 19195-3.15A, Wickmann 19343-1.6A, or Wickmann 19181-4A)	Front Access Fuse (replacement part number: Wickmann 19193-6.3A)	Front Access Fuse (replacement part number: Wickmann 19195-3.15A or Wickmann 19181-4A)	Front Access Fuse (replacement part number: Wickmann 19193-6.3A)
Bus Overvoltage Protection	for both +5V dc and for +24V dc			
Isolation Voltage (input power to 1769 bus) Verified by one of these dielectric tests	1836V ac for 1s or 2596V dc for 1s or 265V Working Voltage (IEC Class 1 - grounding required)	1200V ac for 1s or 1697V dc for 1s or 75V Working Voltage (IEC Class 1 - grounding required)	1836V ac for 1s or 2596V dc for 1s or 265V Working Voltage (IEC Class 1 - grounding required)	1200V ac for 1s or 1697V dc for 1s or 75V Working Voltage (IEC Class 1 - grounding required)
Power Supply Distance Rating	8 (up to eight I/O modules can be connected on either side of the power supply for a maximum of 16 modules)			

Certifications: UL 508, CSA (Class I, Division 2, Group A, B, C, D), CE

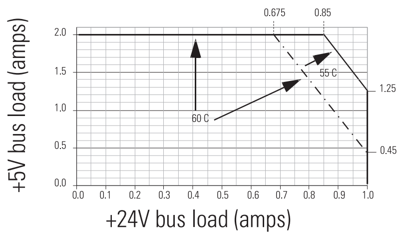
Power Requirements and Transformer Sizing

1769-PA2 output derating

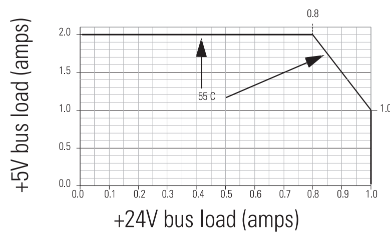
user +24V current draw at 0A



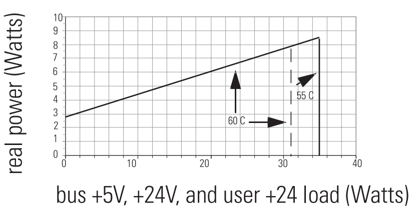
user +24V current draw at 0.2A



user +24V current draw at 0.25A

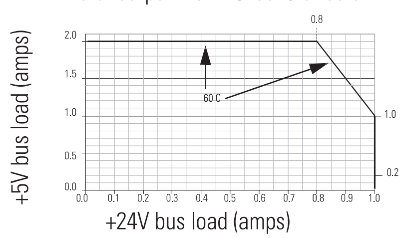


1769-PA2 power dissipation

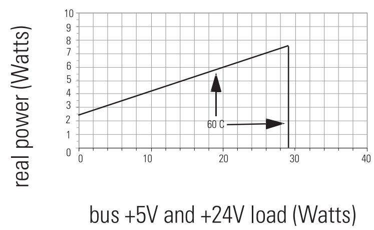


1769-PB2 output derating

total output: 29W @ 60˚C or below

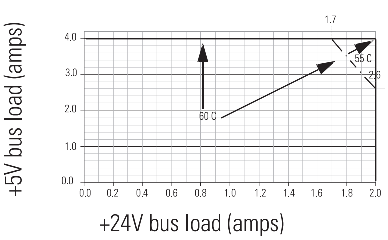


1769-PB2 power dissipation



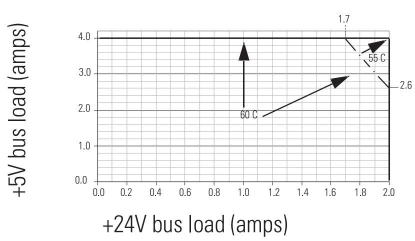
1769-PA4 output derating

total output: 68W @ 55˚C or below
61W @ 60˚C or below

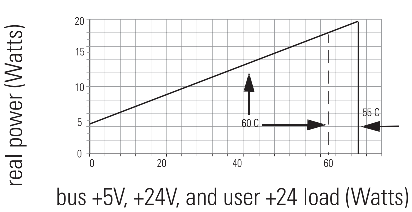


1769-PB4 output derating

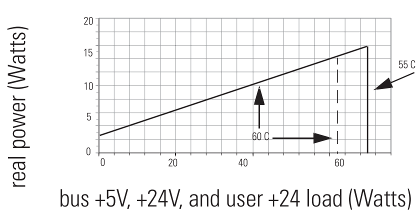
total output: 68W @ 55˚C or below
61W @ 60˚C or below



1769-PA4 power dissipation



1769-PB4 power dissipation



Step 5 - Select:

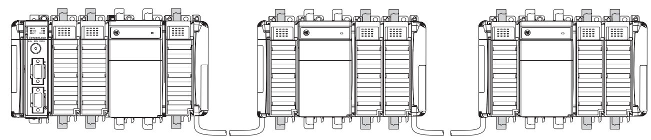
- *panel mount or DIN rail mount*
- *appropriate number of panels or DIn rails based on the number of modules and the physical*
- *one end cap per controller system*

Mounting the CompactLogix System

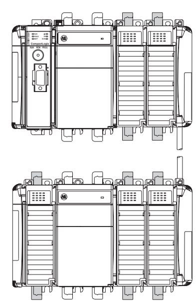
You can panel mount or DIN rail mount a CompactLogix system. The CompactLogix system must be mounted so that the modules are horizontal to each other.

If you separate modules into multiple banks, the banks can be vertical or horizontal to each other.

Horizontal Orientation



Vertical Orientation



If you decide to use a DIN rail, use steel, 35 x 7.55mm DIN rails (A-B part number 199-DR1; 46277-3; EN 50022). The DIN rails for all CompactLogix system components must be mounted on a common, conductive surface to ensure proper electromagnetic interference (EMI) performance.

Grounding the system

You can ground a CompactLogix system through the:

- non-coated, steel DIN rail
- panel-mount screw hole containing the ground strap

Dividing I/O modules into separate banks

The controller is the leftmost module in the CompactLogix system. The controller has built-in termination, so the leftmost end of the system is terminated.

The final I/O bank in the CompactLogix system needs an end cap on the end without the expansion cable.

If you divide the modules into multiple banks:

- the controller must be in the leftmost position of the first bank
- each bank needs its own power supply
- use expansion cables to connect the banks
- the last I/O bank requires an end cap

If you add a:	And connect the chassis from:	Use this cable:✶
second bank	right to left	1769-CRLx
	right to right	1769-CRRx
third bank (1769-L35E, -L32E, -L31, -L30 controllers only)	right to left	1769-CRLx
	right to right	1769CRRx
	left to left	1769-CLLx

✶Where x = 1 for 1 ft. (305 mm) or 3 for 3.28 ft. (1 m)

Power Supply Distance Rating

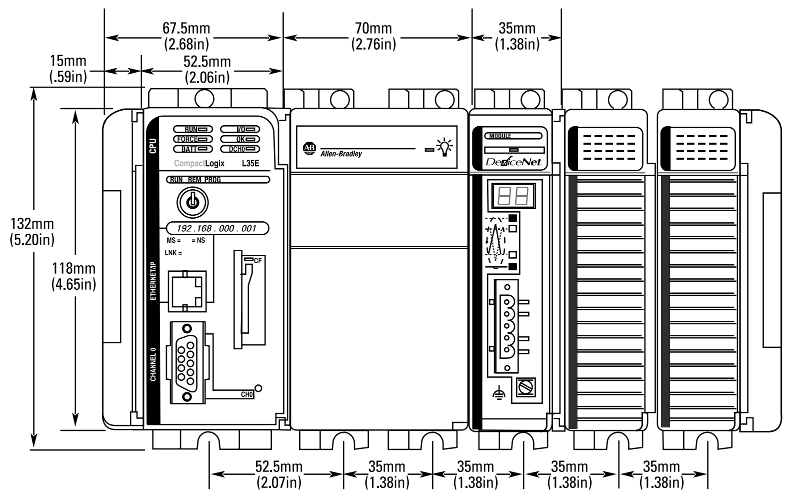
Modules can be placed to the left and the right of the power supply. As many as eight I/O modules can be placed on each side of the power supply.

Each 1769 module also has a power supply distance rating (the number of modules from the power supply). Each module must be located within its distance rating. See the specs for the module to determine its distance rating.

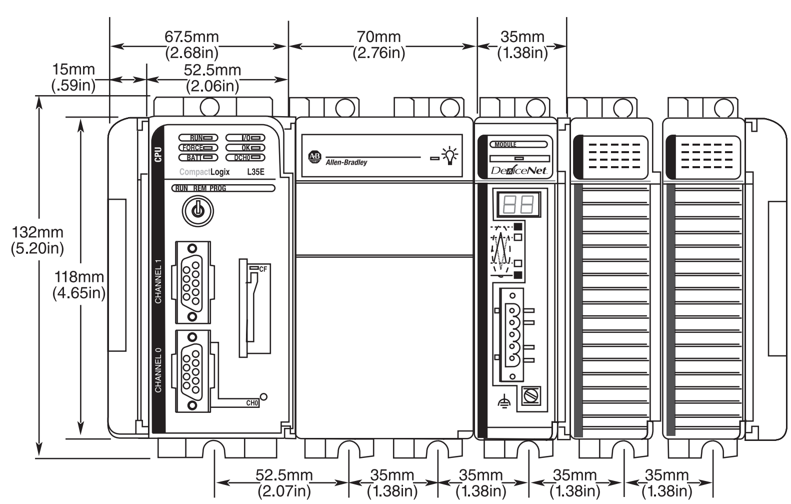
The CompactLogix controller has a power supply distance rating of 4 modules. The controller must be the leftmost module in the first bank of the system. The maximum configuration for the first bank of a CompactLogix controller is the controller and three I/O modules to the left of the power supply and eight I/O modules to the right of the power supply.

Mounting Dimensions

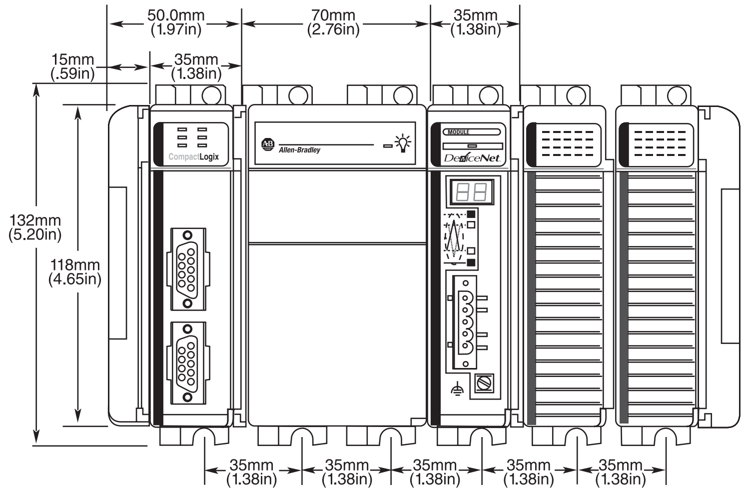
1769-L32E, 1769-L35E CompactLogix controller



1769-L31 CompactLogix controller



1769-L20, -L30 CompactLogix controller



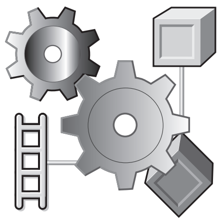
Step 6 - Select:
- *the appropriate package of RSLogix 5000 Enterprise Series software and any options*
- *other software packages for your application*

Selecting Software

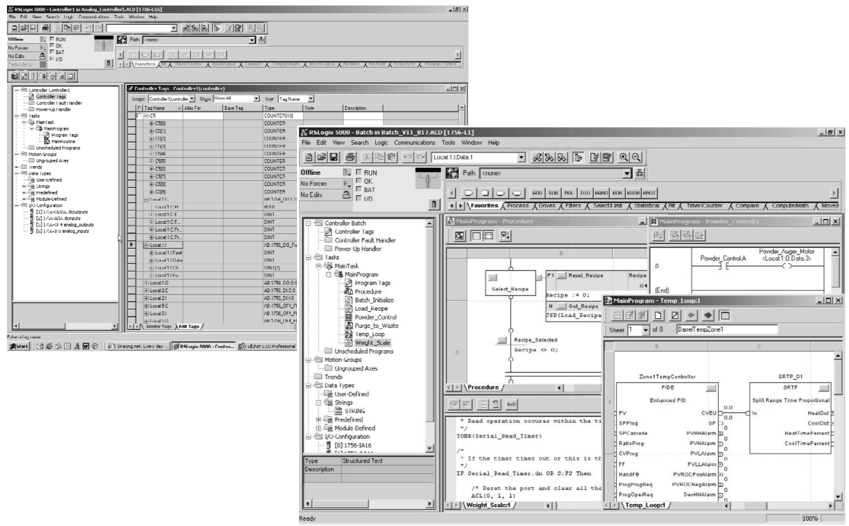
Your selection of modules and network configuration determines what software packages you need to configure and program your system.

If you have a:	You need:	Order this catalog number:
1769 CompactLogix controller	RSLogix 5000 Enterprise Series software	9324 series (RSLogix 5000 Enterprise Series software)
EtherNet/IP interface (set the IP address)	RSLinx software (RSLinx Lite and Bootp server come with RSLogix 5000 Enterprise Series software) **or** RSNetWorx for EtherNet/IP (comes with the standard/NetWorx option of RSLogix 5000 Enterprise Series software)	9324 series (RSLogix 5000 Enterprise Series software) **or** 9324-RLD300NXENE (RSLogix 5000 Enterprise Series software plus RSNetWorx option) **or** 9357-ENETL3 (RSNetWorx for EtherNet/IP)
ControlNet interface	RSNetWorx for ControlNet (comes with the standard/NetWorx option of RSLogix 5000 Enterprise Series software)	9324-RLD300NXENE (RSLogix 5000 Enterprise Series software plus RSNetWorx option) **or** 9357-CNETL3 (RSNetWorx for ControlNet)
DeviceNet interface	RSNetWorx for DeviceNet (comes with the standard/NetWorx option of RSLogix 5000 Enterprise Series software)	9324-RLD300NXENE (RSLogix 5000 Enterprise Series software plus RSNetWorx option) **or** 9357-DNETL3 (RSNetWorx for DeviceNet)
communication card in a workstation	RSLinx software (RSLinx Lite comes with RSLogix 5000 Enterprise Series software)	9324 series (RSLogix 5000 Enterprise Series software)
Logix-based system you want to emulate	RSLogix Emulate 5000	9310-WED200ENE
operator interface	RSView Enterprise series software	ViewAnyWare products

Programming Software



RSLogix 5000 Enterprise Series software is designed to work with Rockwell Automation’s Logix platforms. RSLogix 5000 Enterprise Series software is an IEC 61131-3 compliant software package that offers relay ladder, structured text, function block diagram, and sequential function chart editors for you to develop application programs. RSLogix 5000 Enterprise Series software also includes axis configuration and programming support for motion control.



RSLogix 5000 Enterprise Series software requirements

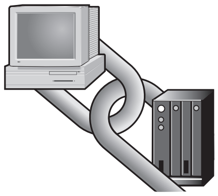
Description	Value
personal computer	Pentium II 450 MHz minimum Pentium III 733 MHz (or better) recommended
software requirements	Supported operating systems: • Microsoft Windows XP Professional version 2002 (with Service Pack 1) or XP Home version 2002 • Microsoft Windows 2000 Professional with Service Pack 1, 2, or 3 • Microsoft Windows NT version 4.0 with Service Pack 5 or 6A
RAM	128 Mbytes of RAM minimum 256 Mbytes of RAM recommended
hard disk space	100 Mbytes of free hard disk space (or more based on application requirements)
video requirements	256-color VGA graphics adapter 800 x 600 minimum resolution (True Color 1024 x 768 recommended)

Selecting the programming package

Available Features	Service Edition 9324-RLD000xxE✶†	Mini Edition 9324-RLD200xxE✶	Lite Edition 9324-RLD250xxE✶	Standard Edition 9324-RLD300xxE✶	Standard/ NetWorx Edition 9324-RLD300NXxxE✶	Full Edition 9324-RLD600xxE✶‡	Professional Edition 9324-RLD700NXxxE✶
Logix5000 controllers supported	all	CompactLogix5300 FlexLogix5400	CompactLogix5300 FlexLogix5400	all	all	all	all
Relay ladder editor§	view only	fully supported	fully supported	fully supported	fully supported	fully supported	fully supported
Function block diagram editor 9324-RLDFBDENE§	view only	upload/download only editor available separately	fully supported	upload/download only editor available separately	upload/download only editor available separately	fully supported	fully supported
Sequential function chart editor 9324-RLDSFCE§	view only	upload/download only editor available separately	fully supported	editor upload/download only available separately	upload/download only editor available separately	fully supported	fully supported
Structured text editor 9324-RLDSTXE§	view only	upload/download only editor available separately	fully supported	upload/download only editor available separately	upload/download only editor available separately	fully supported	fully supported
Highly-integrated motion	view only	upload/download only	upload/download only	fully supported	fully supported	fully supported	fully supported
Graphical trending	fully supported	na	na	fully supported	fully supported	fully supported	fully supported
DriveExecutive™ Lite 9303-4DTE01ENE	available separately	available separately	available separately	included	included	included	included
PIDE autotune 9323-ATUNEENE	available separately	available separately	available separately	available separately	available separately	available separately	included
RSLogix Emulate 5000 and RSTestStand Lite 9310-WED200ENE	available separately	available separately	available separately	available separately	available separately	available separately	included
RSMACC audit support	na	na	na	na	na	na	available separately
Logix CPU security tool	included	included	included	included	included	included	included
Routine source protection tool	included	included	included	included	included	included	included
RSMACC authenticate (security server) client	included	included	included	included	included	included	included
Standalone security server explorer	included	included	included	included	included	included	included
RSLinx	Lite included	Lite included	Lite included	Lite included	Lite included	Lite included	Professional included➤
RSNetWorx for ControlNet RSNetWorx for DeviceNet RSNetWorx for EtherNet/IP⌘	available separately	available separately	available separately	available separately	included➤	available separately	included➤
FBD ActiveX faceplates	included	included	included	included	included	included	included
Tag data upload/download tool	included	included	included	included	included	included	included
RSLogix 5000 project compare tool	included	included	included	included	included	included	included
Tag custom data monitor tool	included	included	included	included	included	included	included
RSView demo (50 tags/2 hours)	available separately	available separately	available separately	available separately	available separately	available separately	included
Upgrades	Service to Standard: 9324-RLD0U3xxE Service to Full: 9324-RLD0U6xxE Service to Professional: 9324-RLD0U7xxE	Mini to Standard: 9324-RLD2U3xxE Mini to Full: 9324-RLD2U6xxE Mini to Professional: 9324-RLD2U7xxE	Lite to Full: 9324-RLD25U6xxE Lite to Professional: 9324-RLD25U7xxE	Standard to Professional: 9324-RLD3U7xxE Multi-language pack extends Standard to Full♣	Multi-language pack extends Standard to Full♣	Full to Professional: 9324-RLD6U7xxE	na

✶Replace "xx" in the catalog number with the appropriate language designation: EN=English, FR=French, DE=German, IT=Italian, PT=Portuguese, and ES=Spanish.
†Available as of RSLogix 5000 programming software version 12.
‡Available as of RSLogix 5000 programming software version 10.02.
§A multiple language editor package is available as 9324-RLDMLPE. It contains the function block, sequential function chart, and structured text editors at a reduced price.
♣The multiple language editor package (9324-RLDMLPE) is not the same as an upgrade, but it extends the programming languages to match those in a Full package.
➤Bundled RSNetWorx and RSLinx Professional packages use the RSLogix 5000 activation and must be installed on the same PC.
⌘RSNetWorx for ControlNet is available as 9357-CNETL3. RSNetWorx for DeviceNet is available as 9357-DNETL3. RSNetWorx for EtherNet/IP is available as 9357-ENETL3. They are available together as 9357-ANETL3.

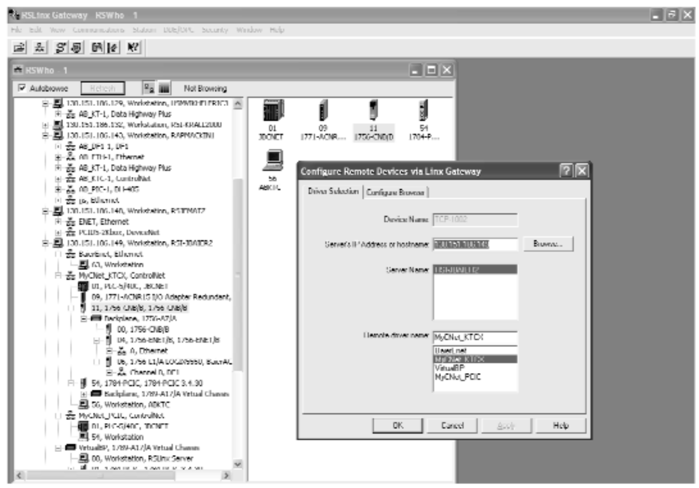
RSLinx Software



RSLinx software (9355 series) is a communication server package that provides plant-floor device connectivity for a wide variety of applications. RSLinx can support multiple software applications simultaneously communicating to a variety of devices on many different networks.

RSLinx provides a user-friendly graphical interface for navigating through your network. Select a device and click to access a variety of integrated configuration and monitoring tools. A complete set of communication drivers is provided for your networking needs, including legacy Allen-Bradley networks.

RSLinx is available in multiple packages to meet the demand for a variety of cost and functionality requirements.

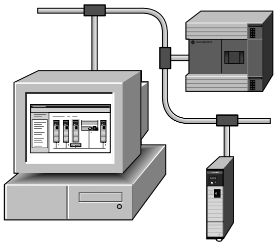


RSLinx system requirements

Description	Value
personal computer	Pentium100 MHz processor (faster processors will improve performance)
operating system	Supported operating systems: • Microsoft Windows XP • Microsoft Windows 2000 • Microsoft Windows NT version 4.0 with Service Pack 3 or greater • Microsoft Windows ME • Microsoft Windows 98
RAM	32 Mbytes of RAM minimum 64 Mbytes or more of RAM recommended
hard disk space	35 Mbytes of free hard disk space (or more based on application requirements)
video requirements	16-color VGA graphics display 800 x 600 or greater resolution

In most cases, RSLinx Lite software comes bundled with controller programming software packages.

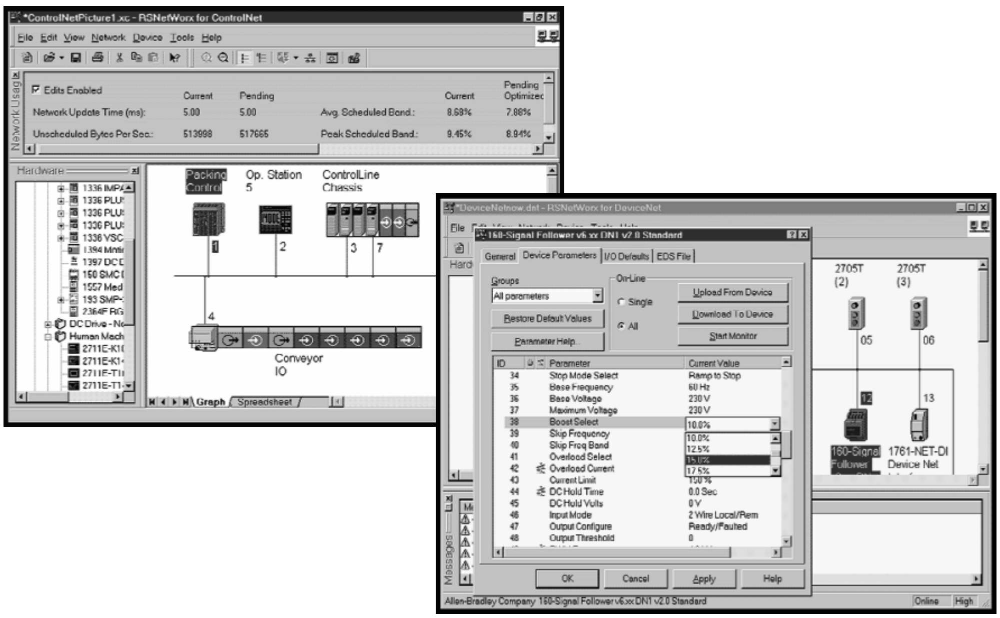
Network Configuration Software



RSNetWorx software is the configuration tool for your control network. With RSNetWorx software you can create a graphical representation of your network configuration and configure the parameters that define your network.

Use RSNetWorx for:

- ControlNet to schedule network components. The software automatically calculates network bandwidth for the entire network, as well as the bandwidth used by each network component. You must have RSNetWorx software to configure and schedule ControlNet networks.
- DeviceNet to configure DeviceNet I/O devices and create a scan list. The DeviceNet scanner stores the configuration information and scan list.
- EtherNet/IP to configure EtherNet/IP devices using IP addresses or host names.



RSNetWorx system requirements

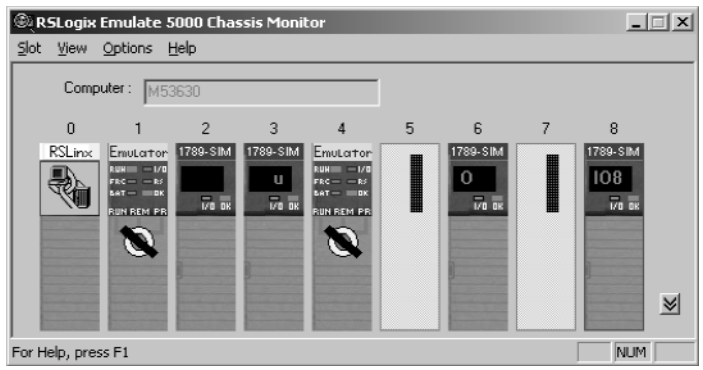
Description	ControlNet	DeviceNet	EtherNet/IP
personal computer	Intel Pentium or Pentium-compatible computer		
operating system	Supported operating systems: • Microsoft Windows XP • Microsoft Windows 2000 • Microsoft Windows 2000 Terminal Server • Microsoft Windows NT version 4.0 with Service Pack 6 or greater • Microsoft Windows ME • Microsoft Windows 98		
RAM	32 Mbytes of RAM minimum more memory is required for large networks		
hard disk space	minimum: 115 Mbytes (includes program files and hardware files) full support: 168...193 Mbytes (includes program files, online help, tutorial, and hardware files)	minimum: 190 Mbytes (includes program files and hardware files) full support: 230...565 Mbytes (includes program files, online help, tutorial, and hardware files)	minimum: 108 Mbytes (includes program files and hardware files) full support: 115...125 Mbytes (includes program files, online help, tutorial, and hardware files)
video requirements	16-color VGA graphics adapter 640 x 480 resolution minimum 800 x 600 resolution recommended		
other	RSLinx Lite 2.4 or later to use RSNetWorx online	RSLinx Lite 2.4 or later to use RSNetWorx online	RSLinx Lite 2.41 or later to use RSNetWorx online

In most cases, RSNetWorx software comes bundled with controller programming software packages.

RSLogix Emulate 5000 Software

RSLogix Emulate 5000 (9310-WED200ENE) is the software emulation package for the Logix5000 controllers. RSLogix Emulate 5000 used in conjunction with RSLogix 5000 software lets you run and debug your application code while at your computer. In addition, RSLogix Emulate 5000 also lets you test HMI screens, developed in RSView for example, without the need to connect to a real controller.

You can set tracepoint and breakpoint instructions (ladder diagram only) in your application code, use traces, and also vary the execution speed of the emulator. RSLogix Emulate 5000 supports all the programming languages (ladder diagram, function block diagram, structured text, and sequential function chart). RSLogix Emulate 5000 does not allow for control of real I/O.



RSLogix Emulate 5000 system requirements

Description	Value
personal computer	IBM-compatible Intel Pentium II 300 MHz or Celeron 300A (Pentium III 600 MHz recommended)
operating system	Supported operating systems: • Microsoft Windows XP with Service Pack 1or greater • Microsoft Windows 2000 with Service Pack 2 or greater • Microsoft Windows NT version 4.0 with Service Pack 6A or greater
RAM	128 Mbytes of RAM minimum
hard disk space	50 Mbytes of free hard disk space
video requirements	16-color VGA graphics display 800 x 600 or greater resolution

RSLogix Emulate 5000 includes RSTestStand Lite. RSTestStand Lite lets you create virtual operator consoles that can help test your application code. RSTestStand Lite can be upgraded to the standard version by ordering catalog number 9310-TSTNDENE.

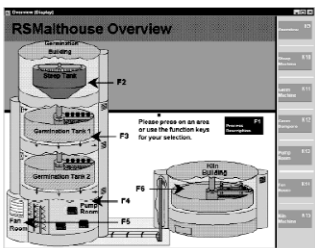
RSLogix Emulate 5000 and RSTestStand Lite are included with the RSLogix 5000 Professional edition.

ViewAnyWare

ViewAnyWare products, together with Logix for control and NetLinx architecture for communication, make up Rockwell Automation's Integrated Architecture strategy. The ViewAnyWare strategy combines Rockwell Automation's expertise in Allen-Bradley electronic operator interface and industrialized PC hardware with Rockwell Software's supervisory control software. Current ViewAnyWare products include:

- RSView Enterprise Series™ software
- PanelView Plus™ operator interface
- VersaView™ industrial computers and monitors
- VersaView CE industrial computer
- MobileView™ portable HMI

RSView Enterprise Series software



RSView Enterprise Series from Rockwell Software is a line of HMI software products designed with a common look, feel, and navigation to help speed HMI application development and training time. With RSView Enterprise Series 3.0, you can reference existing Logix data tags. Any changes made to these referenced tags are automatically inherited by RSView. RSView Enterprise Series software includes:

- RSView Studio™ lets you create applications in a single design environment. It configures Supervisory Edition, Machine Edition, VersaView CE, and PanelView Plus. It supports editing and reusing projects for improved portability between embedded machine and supervisory HMI systems.
- RSView Machine Edition™ (ME) is a machine-level HMI product that supports both open and dedicated operator interface solutions. It provides a consistent operator interface across multiple platforms (including Microsoft Windows CE, Windows 2000/XP, and PanelView Plus solutions), and is ideal for monitoring and controlling individual machines or small processes.
- RSView Supervisory Edition™ (SE) is an HMI software for supervisory-level monitoring and control applications. It has a distributed and scalable architecture that supports distributed-server/multi-user applications. This highly scalable architecture can be applied to a stand-alone, one-server/one-user application or to multiple users interfacing with multiple servers.

RSView Enterprise Series Product Line	Cat. No.	Description
RSView Studio	9701-VWSTENE	RSView Studio for RSView Enterprise Series
	9701-VWSTMENE	RSView Studio for Machine Edition
RSView Machine Edition	9701-VWMR015AENE	RSView ME Station runtime for Windows 2000, 15 displays
	9701-VWMR030AENE	RSView ME Station runtime for Windows 2000, 30 displays
	9701-VWMR075AENE	RSView ME Station runtime for Windows 2000, 75 displays
RSView Supervisory Edition	9701-VWSCWAENE	RSView SE client
	9701-VWSCRAENE	RSView SE view client
	9701-VWSS025AENE	RSView SE server 25 displays
	9701-VWSS100AENE	RSView SE server 100 displays
	9701-VWSS250AENE	RSView SE server 250 displays
	9701-VWSS000AENE	RSView SE server unlimited display
	9701-VWB025AENE	RSView SE station 25 displays
	9701-VWB100AENE	RSView SE station 100 displays
	9701-VWB250AENE	RSView SE station 250 displays
	9701-VWSB000AENE	RSView SE station unlimited display

PanelView Plus operator interface

PanelView Plus is ideal for applications with a need to monitor, control, and display information graphically, allowing operators to quickly understand the status of their application. PanelView Plus is programmed with RSView Studio and has embedded RSView Machine Edition functionality. It combines the best features from the popular Allen-Bradley PanelView Standard and PanelView "e" operator interface products and adds new functionality including:

- multi-vendor communications
- trending
- expressions
- data logging
- animation
- RSView Studio direct browsing of RSLogix 5000 addresses

VersaView industrial computers and monitors

VersaView is a family of industrial computer and monitor solutions, comprised of integrated display computers, workstations, non-display computers and flat panel monitors. VersaView products offer effortless management of changing technology, a rugged but cost-effective design, and easier product configuration. All VersaView products provide the latest industrial solution available, optimized for visualization, control, information processing, and maintenance application. RSView ME, RSView SE client, and RSView SE server runtimes are installed (separate activation is required).

VersaView CE industrial computers

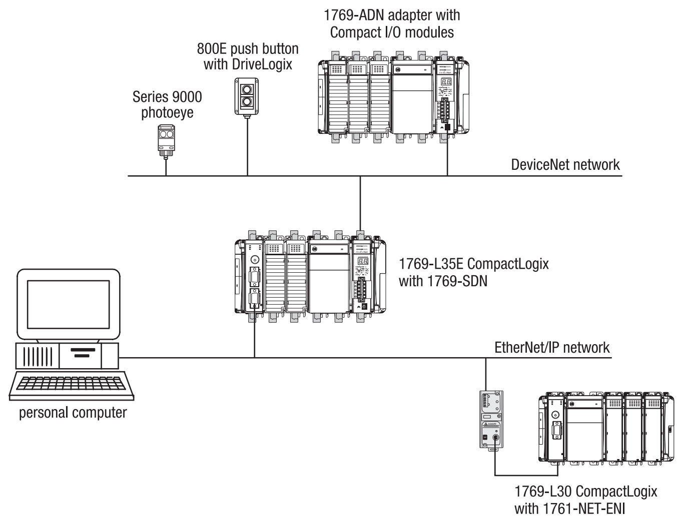
VersaView CE is an open Windows CE terminal with a Windows desktop environment - bringing together features of operator interfaces and industrial computers. It is a high performance computer with a compact flash drive and integrated RSView Machine Edition runtime (no activation required). There's no hard disk, no fan, and no moving parts, which means maximum reliability on the plant floor. Easy to set up and maintain, VersaView CE means an open system that's rugged and economical, offering high functionality in an easy to use package.

MobileView portable HMI

The MobileView family of portable HMI products lets personnel move around a machine or down a production line throughout the entire plant, resulting in greater worker and plant productivity. The MobileView interfaces let manufacturers have information and machine control wherever it is required. MobileView Machine and Guard terminals are available with RSView Machine Edition running locally, eliminating the need for a server. Or, MobileView terminals act as thin clients to computer applications, such as RSView Supervisory Edition, to easily integrate into new or existing control architectures.

Summary

Use a spreadsheet to record the amount and type of devices your CompactLogix system needs. For example, this sample system:



could result in this spreadsheet:

Controller 1 - 1769-L35E				
Device	**Number of Points Needed**	**Cat. No.**	**I/O Points per Module**	**Number of Modules**
120V ac digital inputs	12	1769-IA816	16	1
4-20mA analog inputs	3	1769-IF4XOF2	4	1
4-20mA analog outputs	2	1769-IF4XOF2	2	1 (part of same module from analog input requirements)
DeviceNet scanner	na	1769-SDN	na	1
DeviceNet adapter	na	1769-ADN	na	1
remote 24V dc digital outputs	30	1769-OB16	16	2
remote contact outputs	3	1769-OW6	6	1
Controller 1 subtotal				2 local 1769 I/O modules 1 1769-SDN 1 remote 1769-ADN 3 remote 1769 I/O modules

Controller 2 - 1769-L30				
Device	**Number of Points Needed**	**Cat. No.**	**I/O Points per Module**	**Number of Modules**
24V dc digital outputs	28	1769-OB16	16	2
high-speed counter	na	1769-HSC	na	1
EtherNet/IP interface devices	na	1761-NET-ENI	na	1
Controller 2 subtotal				3 I/O modules 1 1761-NET-ENI

As you select devices for your CompactLogix system, keep in mind:

✓	Step	Remember to Select
	1 Select I/O devices **Important:** For 1769-L20, -L30 controllers, verify backplane memory use to make sure that the controller can support the proposed system. See the worksheet at the back of this guide.	• I/O modules • wiring system (if you want to use a wiring system instead of the terminal block that comes with module) • PanelConnect modules and cables if connecting input modules to sensors • expansion cables if planning multiple banks of I/O modules
	2 Select communication modules	• networks • communication interfaces • associated cable(s) and network equipment Some networks have companion documents to help you select the appropriate equipment. See your Rockwell Automation representative for information.
	3 Select controllers **Important:** The 1769-L3xx controllers offer considerably better performance and more I/O capacity than the 1769-L20, -L30 controllers. Make sure to consider these specifications when selecting the right controller.	• a controller with sufficient memory • a controller with sufficient performance and capacity • replacement batteries • a CompactFlash card for a 1769-L3xx controller
	4 Select power supplies and ensure sufficient power	• if power consumption exceeds the maximum for a single power supply, install additional banks and power supplies
	5 Select the mounting requirements	• panel mount or DIN rail mount • appropriate number of panels or DIn rails based on the number of modules and the physical • one end cap per controller system
	6 Select software	• the appropriate package of RSLogix 5000 Enterprise Series software and any options • other software packages for your application

As you determine placement of the modules you selected, use the worksheets on the next pages to calculate power requirements and to record placement of modules. Make a copy of this worksheet for each controller.

Calculating system power requirements

Compact I/O power supplies distribute power from either side of the power supply. For example, a 2A at 5V dc power supply (1769-PA2, -PB2) can provide 1A to the right side of the power supply and 1A to the left. A 4A at 5V dc power supply (1769-PA4, -PB4) can provide 2A to the right side of the power supply and 2A to the left.

Cat. No.	Number of Modules	Module Current Requirements (mA)		Calculated Current (mA) = (number of modules) x (module current requirements)	
		5V dc	24V dc	5V dc	24V dc
1769-HSC		425	0		
1769-IA8I		90	0		
1769-IA16		115	0		
1769-IF4		120	60		
1769-IF4XOF2		120	160		
1769-IF8		120	70		
1769-IM12		100	0		
1769-IQ16		115	0		
1769-IQ16F		110	0		
1769-IQ32		170	0		
1769-IQ6XOW4		105	50		
1769-IR6		100	45		
1769-IT6		100	40		
1769-OA8		145	0		
1769-OA16		225	0		
1769-OB8		145	0		
1769-OB16		200	0		
1769-OB16P		160	0		
1769-OB32		300	0		
1769-OF2		120	120		
1769-OF8C		145	160		
1769-OF8V		145	125		
1769-OV16		200	0		
1769-OW8		125	100		
1769-OW8I		125	100		
1769-OW16		205	180		
1769-L35E		660	90		
1769-L32E		660	90		
1769-L31		330	40		
1769-L30		800	0		
1769-L20		600	0		
1769-ADN		500	0		
1769-SDN		440	0		
1769-ECLV		5	0		
1769-ECRV		5	0		
Total Current Required:†					

VOne 1769-ECL or 1769-ECR end cap/terminator is required in the system. The end cap/terminator used is dependent on your configuration.
†The total current required must not exceed the power supply capacity listed below.

Power supply capacity

Specification	1769-PA2	1769-PB2	1769-PA4	1769-PB4
output current capacity (0° to 55° C)	2A @ 5V dc 0.8A @ 24V dc	2A @ 5V dc 0.8A @ 24V dc	4A @ 5V dc 2A @ 24V dc	4A @ 5V dc 2A @ 24V dc
24V dc user output capacity (0° to 55° C)	250mA	na	na	na

Verifying I/O layout for 1769-L20, -L30 controllers

Each module in a CompactLogix system uses a set amount of backplane memory, in addition to the data that the module stores or transfers. Some modules require a considerable amount of backplane memory. Take this into account when designing your system because it affects how many modules a 1769-L20, -L30 controller can support.

The 1769-L20, -L30 controllers support 256, 16-bit words of backplane data.

Cat. No.	Number of Modules	Number of Words Used	Calculated Number of Words
1769-IA8I		8	
1769-IA16		8	
1769-IM12		8	
1769-IQ16		8	
1769-IQ16F		8	
1769-IQ32		8	
1769-IQ6XOW4		12	
1769-OA8		12	
1769-OA16		12	
1769-OB8		12	
1769-OB16		12	
1769-OB16P		12	
1769-OB32		12	
1769-OV16		12	
1769-OW8		12	
1769-OW8I		12	
1769-OW16		12	
1769-IF4		14	
1769-IF8		63	
1769-OF2		14	
1769-OF8C		84	
1769-OF8V		84	
1769-IF4XOF2		20	
1769-IR6		14	
1769-IT6		16	
1769-HSC		187 (35 words input, 34 words output, 118 words configuration)	
1769-SDN		76 plus total words in scanlist	
system overhead (per controller)		34	34
Total Words Required:V			

VThe total words required for a 1769-L20, -L30 controller cannot exceed 256 words.

When planning local I/O modules for a 1769-L20, -L30 controller, consider:

- The 1769-L20, -L30 controller supports any combination of digital and analog modules without exceeding backplane memory or total module count.
- The 1769-L20, -L30 controller also supports specialty modules, such as the 1769-HSC. Specialty modules require large amounts of backplane memory and can restrict the total number of modules supported by the 1769-L20, -L30 controller.

Record module placement

Use the following charts to record module placement. These charts have positions for the maximum number of modules in an I/O bank. The controller cannot necessarily support modules in all positions. Follow these guidelines as you place modules:

- The controller must be in the leftmost position in bank one. The controller has a power supply distance rating of 4 modules.
- The 1769-L32E, 1769-L35E, and 1769-L35C controllers support 30 local I/O modules in as many as 3 I/O banks.
- The 1769-L31 and 1769-L30 controllers support 16 local I/O modules in as many 3 I/O banks.
- The 1769-L20 controller supports 8 local I/O modules in as many as 2 I/O banks.
- Each I/O bank must have its own power supply.
- For 1769-L20, -L30 controllers, make sure to validate module placement by calculating the total words of backplane memory used.

Bank 1				
Module	**Placement (left or right of power supply)**	**Backplane Memory (words) (1769-L20, -L30 only)**	**Backplane Current @ 5 V (mA)**	**Backplane Current @ 24 V (mA)**
1769-_______ controller	left			
	left			
	left			
	left			
1769-_______ power supply	—	—	—	—
	right			
	right			
	right			
	right			
	right			
	right			
	right			
	right			
1769-ECR right-end capV	right	—	—	—
Totals		words	mA	mA

VYou only need an end cap if this is the last bank in the system.

Bank 2				
Module	**Placement (left or right of power supply)**	**Backplane Memory (words) (1769-L20, -L30 only)**	**Backplane Current @ 5 V (mA)**	**Backplane Current @ 24 V (mA)**
1769-_______ expansion cable	left or right	—	—	—
1769-_______ end capV	left or right	—	—	—
	left			
	left			
	left			
	left			
	left			
	left			
	left			
	left			
1769-_______ power supply	—	—	—	—
	right			
	right			
	right			
	right			
	right			
	right			
	right			
	right			
Totals		words	mA	mA

VYou only need an end cap if this is the last bank in the system. Place an end cap on the end opposite of the expansion cable.

Bank 3 - 1769-L35E and 1769-L30 only				
Module	**Placement (left or right of power supply)**	**Backplane Memory (words) (1769-L20, -L30 only)**	**Backplane Current @ 5 V (mA)**	**Backplane Current @ 24 V (mA)**
1769-_______ expansion cable	left or right	—	—	—
1769-_______ end capV	left or right	—	—	—
	left			
	left			
	left			
	left			
	left			
	left			
	left			
	left			
1769-_______ power supply	—	—	—	—
	right			
	right			
	right			
	right			
	right			
	right			
	right			
	right			
Totals		words	mA	mA

VPlace an end cap on the end opposite of the expansion cable.

CompactLogix 1769-L35E, 1769-L32E, 1769-L31 Specifications

Category	1769-L35E	1769-L32E	1769-L31
Communication Ports	one RS-232 port one EtherNet/IP port	one RS-232 port one EtherNet/IP port	two RS-232 ports
User Memory	1.5 Mbytes	750 Kbytes	512 Kbytes
Nonvolatile Memory Storage	Type I CompactFlash card removal and insertion under power	Type I CompactFlash card removal and insertion under power	Type I CompactFlash card removal and insertion under power
Maximum Number of Local I/O Modules	30 I/O modules	16 I/O modules	16 I/O modules
Maximum Number of I/O Banks	3 I/O banks	3 I/O banks	3 I/O banks
Backplane Current	660 mA @ 5V dc 90 mA @ 24V dc	660 mA @ 5V dc 90 mA @ 24V dc	330 mA @ 5V dc 40 mA @ 24V dc
Backplane Current	4.74 W	4.74 W	2.61 W
Channel 0	RS-232 electrically isolated 9-pin, D-shell DF1, DH-485, ASCII, SCADA	RS-232 electrically isolated 9-pin, D-shell DF1, DH-485, ASCII, SCADA	RS-232 electrically isolated 9-pin, D-shell DF1, DH-485, ASCII, SCADA
Channel 1	EtherNet/IP 10/100 Mbytes/second supports 32 CIP connections	EtherNet/IP 10/100 Mbytes/second supports 32 CIP connections	RS-232 non-isolated 9-pin, D-shell DF1, DH-485
Power Supply Distance Rating	4 slots from power supply	4 slots from power supply	4 slots from power supply
Battery	1769-BA (over 6 months hold-up time)	1769-BA (over 6 months hold-up time)	1769-BA (over 6 months hold-up time)
Operating Temperature	0°...60°C (32°...140°F)	0°...60°C (32°...140°F)	0°...60°C (32°...140°F)

Certifications: UL, CSA (Class I, Division 2, Group A, B, C, D), CE, C-Tick

Notes:

Notes:

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1769-SG001D-EN-P — March 2004
Supercedes 1769-SG001C-EN-P — June 2003

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ENERFLEX LTD.
UNITS 12517, 12518, 31833, 31834
FOR
HUSKY OIL

ENGINE DRIVE AIR COMPRESSORS

ALLEN BRADLEY COMPACTLOGIX PLC CONTROL PANEL

OPERATORS MANUAL

Revision A
2010-06-24

TABLE OF CONTENTS

1. CONTROL SYSTEM OVERVIEW

The compressor control panel automates many aspects of the compressor package. The system accomplishes a number of important functions such as:

- Equipment protection through shutdown logic. The control system will shut the unit down if the operating parameters go outside the preset limits. The cause of a shutdown is displayed on the human machine interface (HMI).
- Automated start sequence: checks permissive-to-start conditions, pre-lubes the unit and sequences the crank, ignition and fuel gas.
- Automatic capacity control of the unit by manipulating the slide valve position and engine speed.
- Manual control through HMI operations.
- Valve control to maintain suction and discharge pressures within operating limits.
- Instrument calibration.
- Real-time and historical trending.

The panel is based on Allen Bradley CompactLogix PLC equipment. It incorporates analog and digital input and output modules to monitor and control the compression equipment and process. The control hardware is housed in a NEMA 4 steel enclosure, and carries CSA Class I Div 2 Group C & D approval. The power supply is 24 VDC with current draw up to 10 A. The engine controllers can draw up to an additional 20 A.

The human-machine interface (HMI) is an Allen Bradley PanelView+ 700 color touch screen mounted in the door of the PLC cabinet. The operator uses the HMI to view all process data, to start and stop the compressor and to update control parameters. Access to critical control parameters is password protected.

The CompactLogix PLC processor (1769-L32E) supports Ethernet and serial RS232 communication. The communication link from the PLC to the HMI is Ethernet via an Ethernet switch located in the panel. The Ethernet switch allows connection to a plant-wide Ethernet system and provides a programming interface. If PLC-HMI communication is lost, the compressor will function safely but the operator will not have control from the HMI.

2. SHUTDOWN AND ALARM CONDITIONS

The most important function of the control system is to protect the equipment by stopping the engine/compressor if conditions are outside safe operating limits. Discrete switches, analog values from transmitters, RTD's, thermocouples or analog values calculated in the PLC can initiate a shutdown. Analog values are compared against pre-determined limits to determine if a shutdown is required. When a shutdown occurs, the cause of the shutdown is displayed on the HMI (first-out shutdown). Any activated shutdown is displayed in red on the annunciator page. The shutdown will return to green if the shutdown condition is cleared and the reset button is pushed.

Shutdowns are divided into four classes as follows:

- Class A: Shutdown must be clear before the unit can start.
- Class B: Shutdown will be bypassed for 120 seconds following start-up. The compressor can start without the "B" shutdown clear or healthy. The compressor will shutdown if any "B" shutdown is active after the time delay. This allows time for operating conditions to stabilize before arming the shutdown.
- Class b: Same as Class B, but time delay is 20 seconds.
- Class C: Shutdown does not activate until the set point is reached.

The control panel is equipped with an emergency shutdown (ESD) pushbutton. The ESD button will disable all equipment on the package forcing the equipment to its fail state. The end user can wire other ESD devices or systems in series with the compressor ESD string. Other shutdowns will disable some or all of the equipment on the package, depending on the severity of the shutdown. The cause and effect relationship of each shutdown is given in the shutdown key.

Alarms are events that are not severe enough to cause a shutdown. However, the information may be of interest to an operator so the alarm is displayed on the HMI.

3. COMPRESSOR START, RUN AND STOP SEQUENCES

The current operating state is displayed on the start-up page. Ensure all setpoints and transmitters are correct before starting the compressor.

- If the message on the top of the screen indicates “Check Shutdowns”, press the RESET button on the touch screen. If all the Class-A shutdowns are clear, the message on the touch screen will indicate “Ready to Start”. If any Class-A shutdowns are not clear, the panel will not reset. Determine the cause by viewing the SHUTDOWN STATUS screens. The condition must be corrected before proceeding.
- Ensure automated control valves are in auto.
- Ensure pre-lube oil pump control is in auto.
- Ensure capacity control is in auto.
- When “Ready to Start” is displayed, press the “START” button to begin the auto-start sequence. The control panel enables the pre-lube pump until the oil pressure setpoints and minimum pre-lube time are satisfied.
- The unit will crank, purge, enable ignition and then enable fuel gas. The engine should start and the crank will be disabled. If the engine is equipped with a Cat ADEM 3, the engine start sequence is initiated by the PLC, but sequenced by the engine controller.
- If the engine does not start within the allowed engine crank-on time, the unit will pause before repeating the sequence. If the engine does not start within the maximum allowed crank attempts, then a crank failure shutdown is generated and displayed. The operator must reset the unit before the sequence can be restarted.
- The compressor will go “on-line” when the engine reaches operating temperature and the engine speed reaches minimum load speed. At this point, the compressor can begin to load.
- The process control functions take control of the speed and valves when the compressor is “on-line”.
- The operator initiates the normal stop sequence by pressing the “STOP” button on the start-up page on the HMI. The compressor unloads and the engine slows to idle for a pre-determined cool-down time.
- In an emergency, press the ESD button to stop the equipment immediately.

4. COMPRESSOR CONTROL DESCRIPTION

Process control maximizes the output of the system while keeping the operating pressures, temperatures and speed within safe limits to prevent a shutdown.

4.1. System Overview

The system consists of two screw compressors drawing air at atmospheric conditions and discharging compressed air into a common header. Two reciprocating compressors draw the air from the header and discharge into a pipeline that feeds 3 injection wells. The site may be expanded to include 3 screw compressors feeding 3 reciprocating compressors.

4.2. Start-up

The operator will start one or two screw compressors. The screw compressors will go through a warm-up sequence. When they are warm and at minimum load speed, process control will take over and they can start to load to meet the discharge pressure requirement.

The operator can start a reciprocating compressor. It may be necessary to open an off-skid bypass valve during recip compressor start-up. Allow process conditions to stabilize before starting the second reciprocating compressor. The recip compressors will go through a warm-up sequence before process control takes over the loading.

4.3. Screw Compressor Process Control

The primary process variable to control the screw compressor loading is the pressure of the common screw compressor discharge header. The plant PLC will monitor the discharge header pressure and send load control setpoints to each screw compressor. The screw compressor control panel will split the load control setpoint to close the bypass valve, close the slide valve and speed up the engine. The division of the load control will be adjustable. For example:

0-20% load	-Controls the bypass valve from 0-100% closed
0-30% load	-Closes the slide valve from 0-100% loaded
0-50% load	-Speeds up the engine from minimum load speed to rated speed

If two screw compressors are on-line, the compressors should be loaded evenly to the point where both compressor bypass valves and slide valves are closed. At this point the compressor speeds can be synchronized or controlled independently in a lead/lag arrangement.

4.4. Reciprocating Compressor Process Control

The primary process variable to control the recip compressor loading is the pressure of the common recip discharge line. The plant PLC will monitor the common discharge pressure and send a load control setpoint to each reciprocating compressor. The load control setpoint will be used to vary the engine speed from minimum load speed to rated speed. The compressor speeds can be synchronized or controlled independently in a lead/lag arrangement.

4.5. Screw Compressor Slide Valve Control

The slide valve position determines the volume of gas that is ultimately compressed. The slide valve is forced to unload in the following operating conditions:

- Start-up
- Warm-up
- Cool-down
- Bypass valve open

The slide valve position is controlled when the unit is “on-line” and the slide valve control mode is “Auto”. The slide valve position setpoint is determined by the process control load setpoint. Timed output pulses are sent to load or unload solenoids. The solenoids allow pressurized oil to move a piston attached to the slide valve. A slide valve position transmitter provides feedback to the controller.

The operator can place slide valve control in manual to force a slide valve position. The operator activates the load or unload-pushbutton on the HMI to move the slide valve.

There are 4 parameters available from the HMI that affect the control of the slide valve. These are load and unload cycle times and pulse multipliers. The load and unload cycle times are the time intervals between load or unload pulses. For example, if the load cycle time is set at 5 seconds and the compressor needs to load, the PLC will send a load pulse every 5 seconds. The duration of the load pulse is determined by the pulse multiplier and by how close the slide valve position is to its setpoint. The pulse multiplier is an arbitrary value. Increase the multipliers to increase the rate at which the slide valve loads or unloads. If the multipliers are too large the load and unload pulses will cause the slide valve to overshoot the setpoint.

4.6. Screw Compressor Vi Control

The compressor slide stop position is controlled with time proportional pulses to the “Vi” increase and decrease solenoid valves. The slide stop is the mating surface for the slide valve when the compressor is 100% loaded. The slide stop determines the internal volume ratio or “Vi” when the compressor is fully loaded. “Vi” is the volume of the trapped gas pocket immediately after it closes to suction, to the volume of the trapped gas pocket immediately before it opens to discharge. The following formula is used to calculate the optimal “Vi” for a specific ratio of absolute discharge pressure to absolute suction pressure. The value “k” is the specific heat ratio of the gas being compressed. Natural gas "k" value is 1.3.

$$Vi = \left(\frac{P_{DISCHARGE(ABS)}}{P_{SUCTION(ABS)}} \right)^{1/k}$$

The moveable slide stop offers a range of “Vi” positions between 2.2 and 5.0. The slide valve has maximum travel with Vi of 2.2 (minimum internal compression ratio). The slide stop moves toward the slide valve when the “Vi” is increased. Therefore the slide valve total travel distance decreases as the “Vi” increases. The slide valve position must be recalibrated (0 to 100%) whenever “Vi” changes. The automatic “Vi” logic periodically sets the optimal slide stop position for the conditions and rescales the slide valve position indication.

4.7. Engine Speed Control

The control system monitors engine speed and sends a signal to the governor or engine controller to vary the engine speed. The engine speed setpoint depends on the run state and operating conditions. Engine speed is maintained at idle during the following conditions:

- Start-up
- Warm-up
- Cool-down

The control system will ramp-up the speed to the “Minimum Load Speed” of the package when the engine is warm. The minimum load speed depends on the engine and the application. The run state changes to “On-Line” and the master speed control takes over when the engine reaches “Minimum Load Speed”. The master speed control varies the engine speed between minimum and maximum load speed as necessary to load and unload the compressor. The process control setpoint determines engine speed during normal operation.

Engine speed control is actuated by a 4-20mA signal from the PLC to the engine governor via an I-P converter or to an engine controller such as the Cat ADEM 3 or Waukesha ESM.

The operator can place engine speed control in manual to force a desired speed.

During a normal stop sequence, the engine slows to idle speed and continues to run for a configurable cool-down period.

4.8. Screw Compressor Discharge Backpressure Control Valve

The discharge backpressure valve closes to build discharge pressure to force oil flow to the compressor bearings. The discharge backpressure valve is usually required during start-up before pressure has had a chance to build in the discharge header.

The operator can place discharge valve control in manual to force a desired position. Discharge valve position is actuated by a 4-20mA signal from the PLC to an I-P transducer or valve position controller.

5. HMI

The human machine interface (HMI) or operator interface for the control system is a PanelView+ 700 touch screen installed in the door of the control enclosure. The HMI enables the operator to monitor the unit, enter operating setpoints and force manual conditions.

5.1. Main Menu

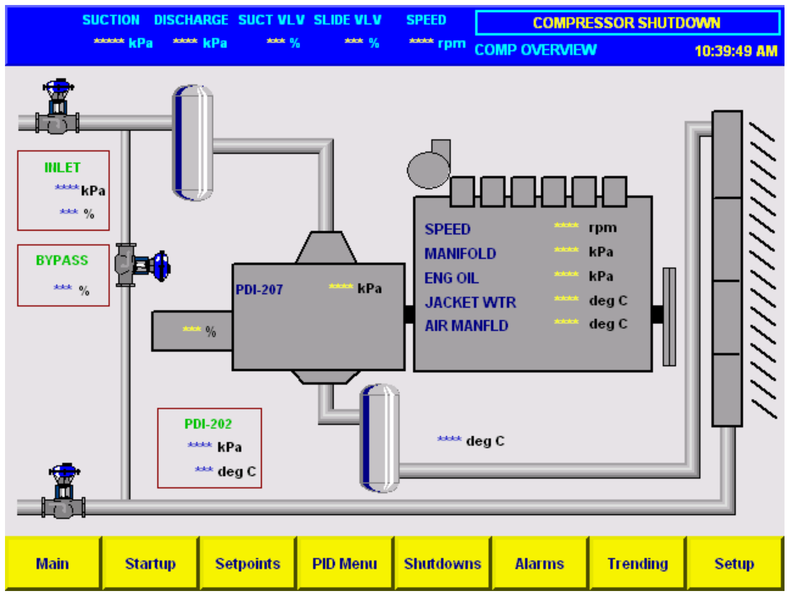
The main screen is the starting point for the operator to access all other screens. Buttons found on the bottom edge allow for easy navigation to other screens.

5.2. Operating Information

Several screens are dedicated to display the current operating data. Analog values found in the process can be viewed on the ‘Compressor Overview’ or one of the ‘Setpoints’ screens.

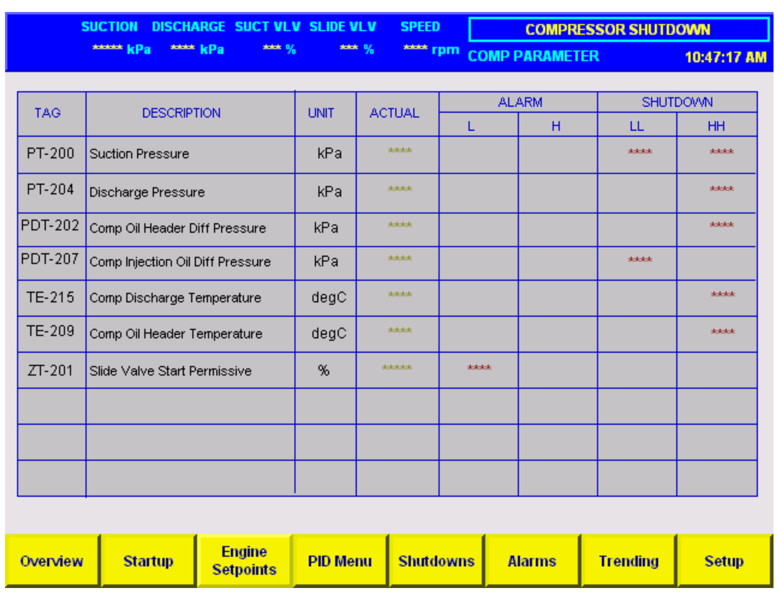
5.2.1. Compressor Overview

The compressor overview screen displays the most critical operating data for the compressor, engine and control valves.



5.2.2. Setpoints

Analog values and alarm and shutdown setpoints can be found on the ‘Setpoints’ screens. These screens allow the user to change alarm setpoints and view shutdown setpoints.



5.3. Alarms and Shutdowns

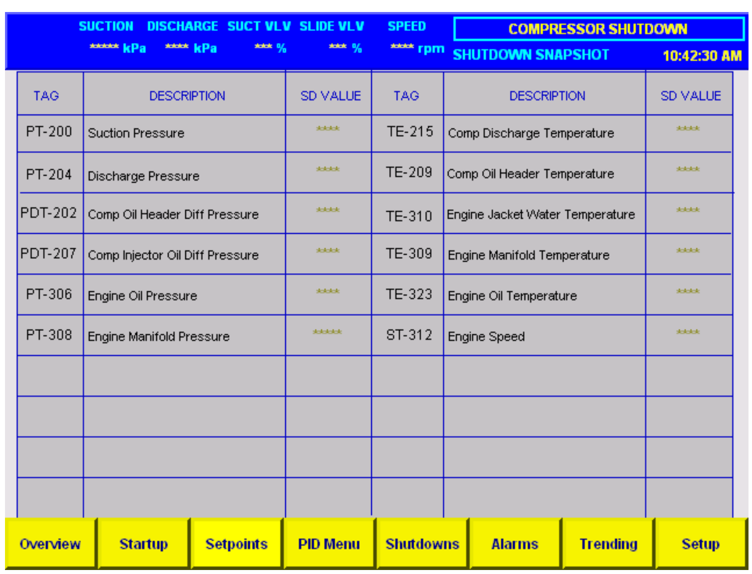
The HMI will display the cause of a shutdown as a banner that must be acknowledged. Active shutdown status information is displayed on the 'Shutdown Status' pages.

5.3.1. Shutdown Status

Shutdown status information can be found on the 'Shutdown Status' pages accessible from most other screens.

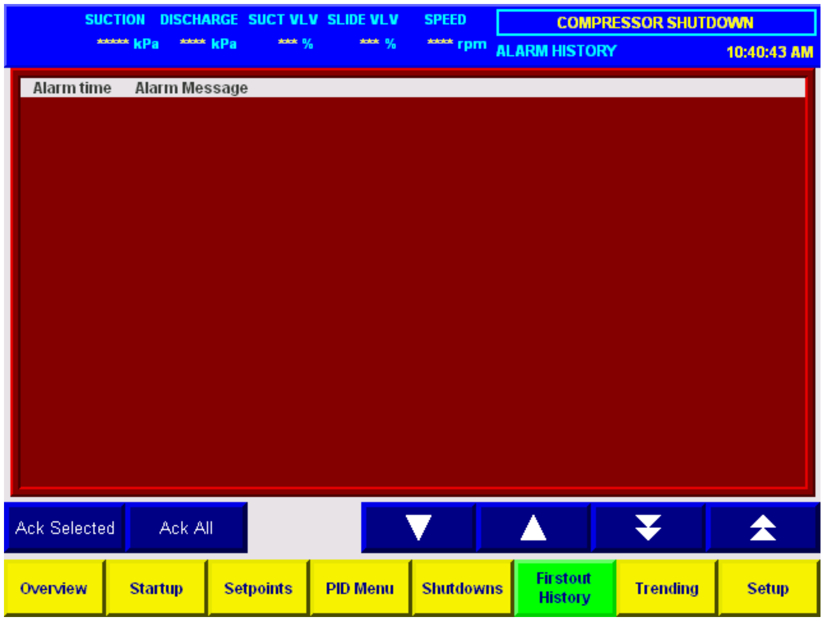
5.3.2. Shutdown Snapshot

The HMI takes a 'Snapshot' of the operating data at the time of a shutdown. The operator can analyze the conditions leading up to the shutdown. It is accessed through either the 'Trending' menu or 'Setup' menu.



5.3.3. Alarm History

The operator can view past alarms on the Alarm History page. This page logs the occurrence of alarm conditions and displays them in a chronological order. First-out alarms are displayed on a separate screen.

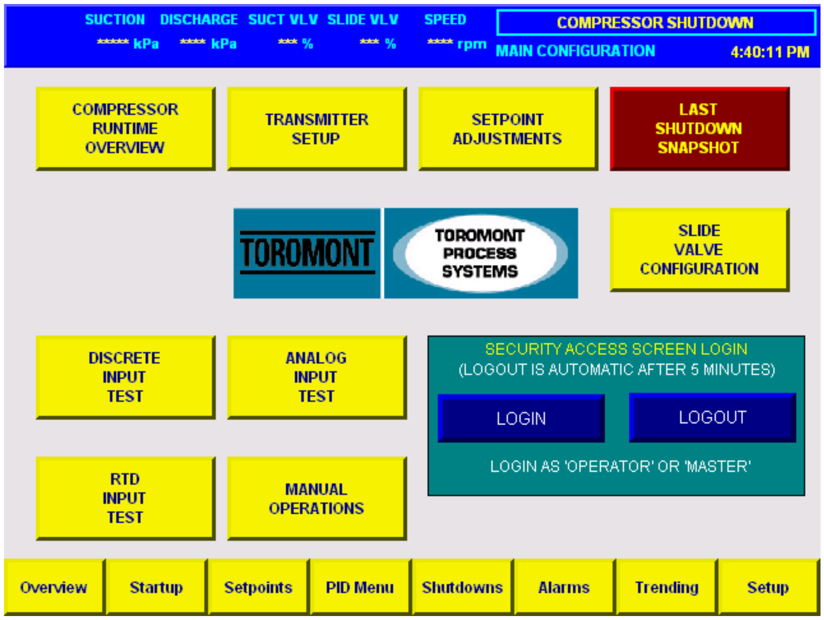


5.4. Configuration Screens

The operator can adjust certain operating parameters from the configuration screen. The settings must be configured prior to running the unit. All configurations are password protected and require an operator to login.

5.4.1. Setup Menu

Use the “SETUP” button to access the main configuration menu.

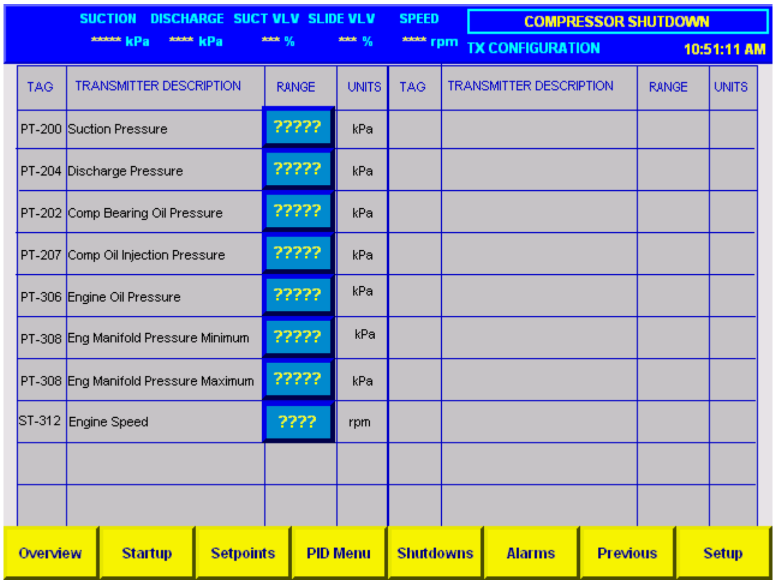


5.4.2. Login Pop-up Screen

Press the LOGIN button to login as ‘operator’. The following pop-up window appears that prompts for a user name and password.

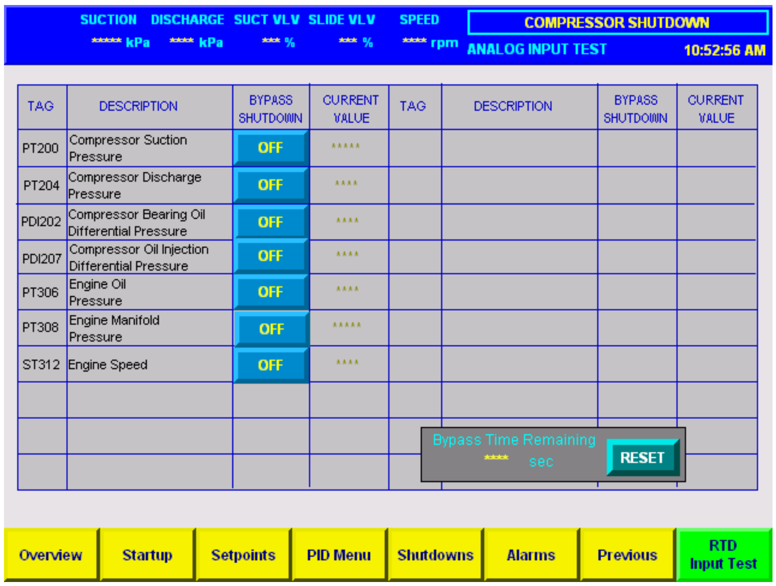
5.4.3. Transmitter Setup and Calibration

The PLC scales 4-20 mA input signals to engineering units based on the calibrated transmitter ranges. Use the transmitter setup and calibration screens to set the transmitter ranges.



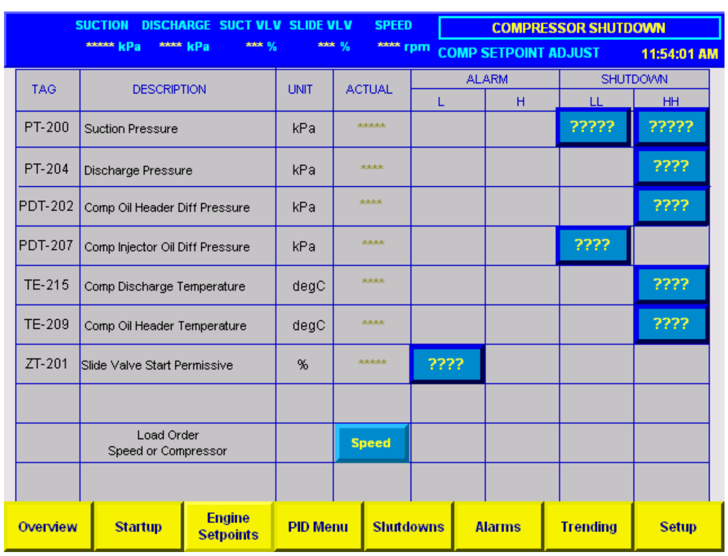
5.4.4. Input Test

Test screens allow a user to bypass shutdowns for a set time period to test the end device and/or PLC input without shutting down the unit. The bypass is timed so a user cannot leave the shutdown bypassed indefinitely. Use the RESET TIMER button to reset the bypass timer. RESET the shutdown before enabling it and before the bypass timer runs out. Access the test screens from the setup menu.



5.4.5. Alarm and Shutdown Setpoints

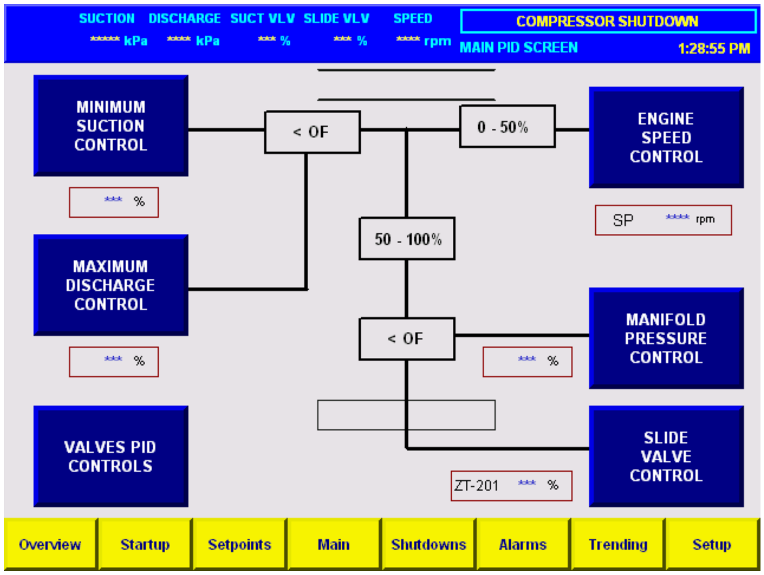
Use the setpoint configuration screens to enter the shutdown setpoints. Some setpoints are protected in the PLC. If a value is entered outside the permissible range the entered value will not be accepted for safety reasons.



5.5. Control Screens

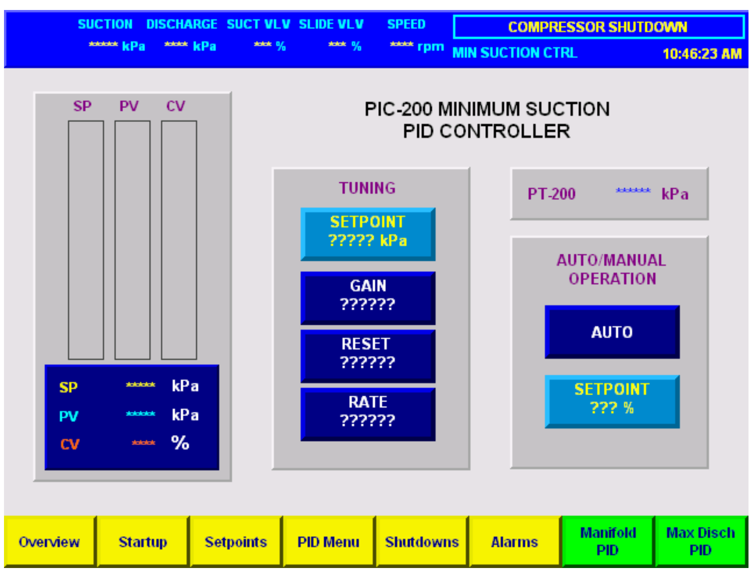
5.5.1. PID Menu

The PID overview screen provides a graphic of the main control configuration and current operating conditions. It allows navigation to individual control screens.



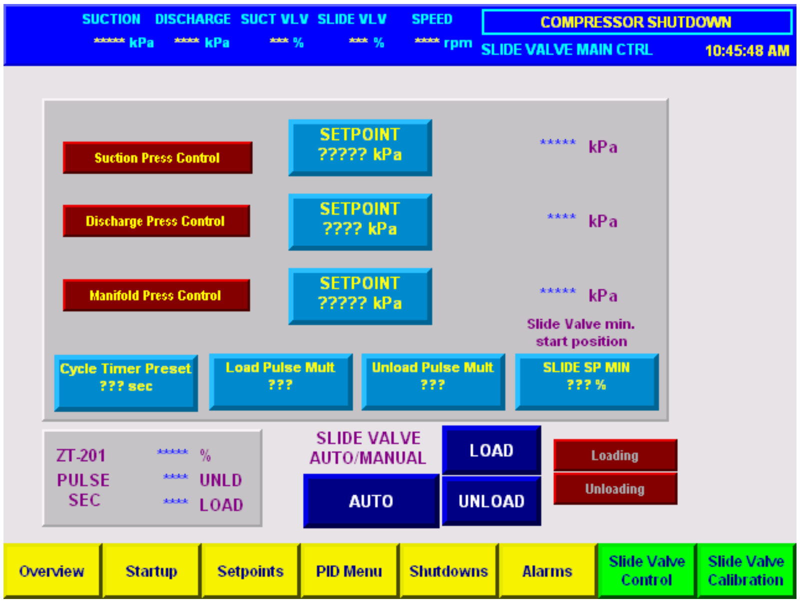
5.5.2. PID Parameter Screens

The operator can adjust setpoints and tuning parameters for the individual PID controllers. Adjust the gain (proportional), reset (integral), and rate (derivative) constants to tune the controller to react to process changes.



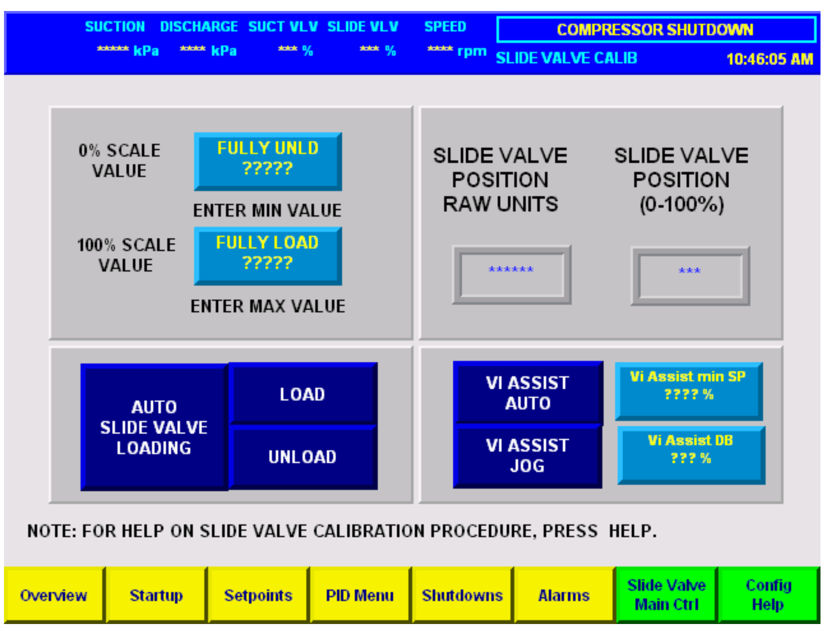
5.5.3. Slide Valve Control

The master slide valve control screen displays information regarding the compressor capacity. The operator can access to the manual load/unload screen and slide valve calibration screen.



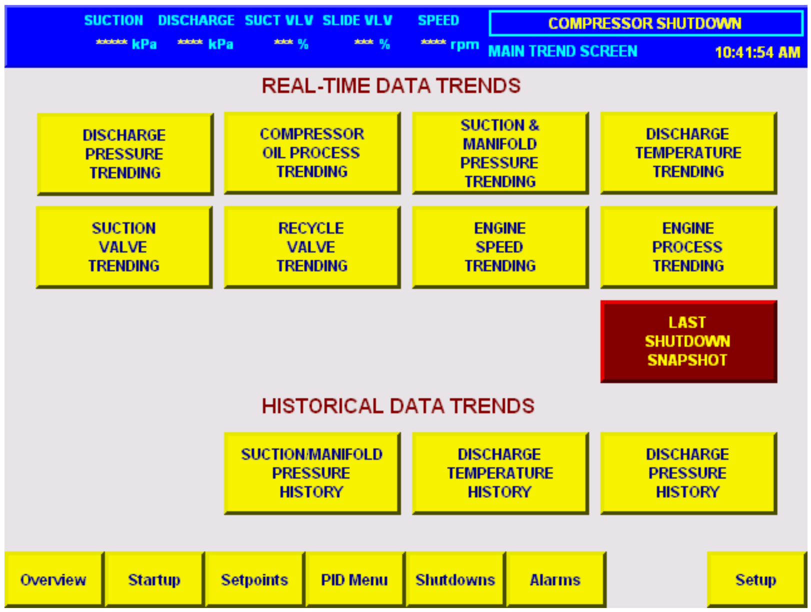
5.5.4. Slide Valve Calibration

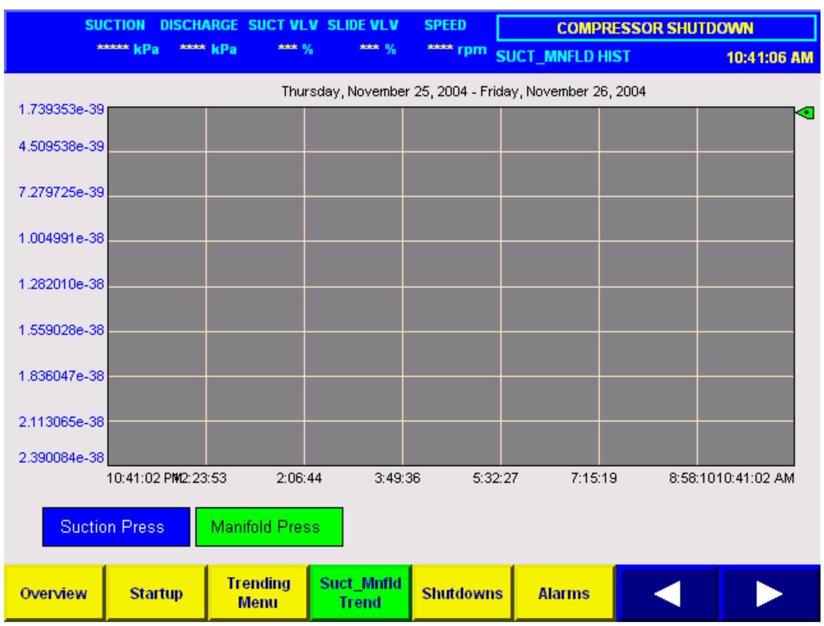
The slide valve must be calibrated for the compressor capacity control to work properly. Enter the raw input values for the slide valve in the fully loaded and unloaded states. The scaled position is also shown so the operator can check the scaling.



5.6. Data Trending screens

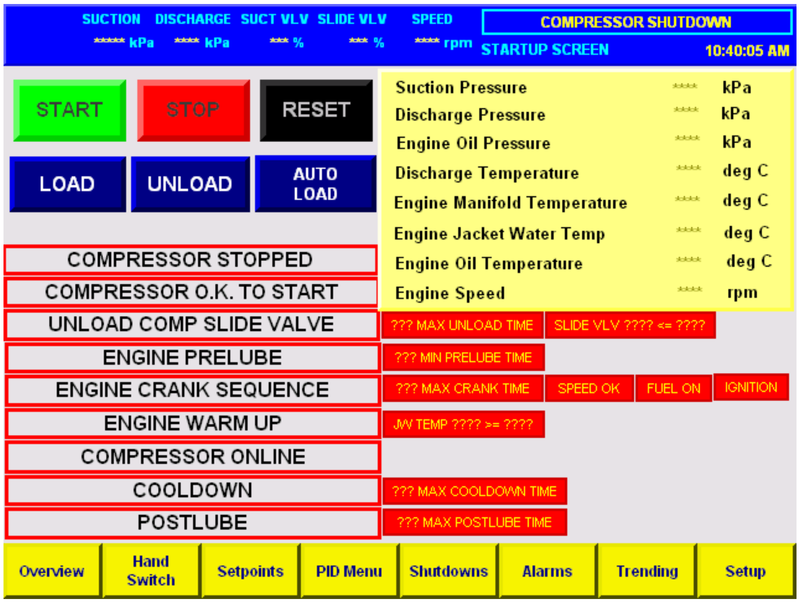
The HMI includes screens for real time and historical operating graphs. These screens are accessible via the 'Trending' button. The operator can access the individual trend screens from the trend menu screen. Each display is a graph of the selected variable over time. The real-time trends trace a line while the screen is displayed. These are useful for tuning PID controls. The historical trends access data stored on a CompactFlash card in the HMI.





5.7. Compressor Start and Stop Screen

The compressor start/stop screen displays all information required to start the compressor. The operator can enable the start sequence and monitor its progress from this screen. The major sequence steps are listed along the left side of the screen. Most steps have sub-steps listed to the right of the major step. A step displays in green when it's complete.



6. SPECIFICATIONS

Overall Specifications		Notes
PLC Cabinet	NEMA 4 steel panel w/locking handle Powder Coated Interior C/W 12 GA steel backpan	
Operating Voltage	24 VDC	Customer supplied or battery. Optional AC power supply
Maximum Input Current	10 A – Control Panel 15 A – Engine Controller	
Operating Temperature (Ambient)	0 - 50°C	
Agency Approval	CSA C/US Class I, Div. 2 Group C and D	

PLC Specifications

Processor	CompactLogix 5332 CPU 750KB memory AB # 1769-L32E CUL Class I, Div. 2	
Analog Modules	2 – Analog input modules - 8 channel AB #: 1769-IF8 1 – Analog output module - 4 channel AB #: 1769-OF4CI CUL Class I, Div. 2	Alternate: 2 – Analog output modules - 2 channel (AB #: 1769-OF2/B)
Digital Modules	1 –Digital input module - 16 channel AB #: 1769-IQ16 1 – Digital output module – 16 channel AB #: 1769-OB16 1 – Digital input/output combo – 6 in/4 out AB #: 1769-IQ6xOW4 CUL Class I, Div. 2	
Temperature Input Modules	1 – RTD input module - 6 channel AB #: 1769-IR6 or 1 – Thermocouple 8 Channel Input Module AB #: 1769sc-IF8u CUL Class I, Div. 2	Option: Additional RTD or thermocouple modules
Communication Protocols	DF1 serial communication Ethernet communication	Option: Modbus communication with 1761-NET-AIC (Required with Waukesha ESM.)
Power Supply	PLC power supply 19.2 to 32 VDC 6A AB #: 1769-PB4 CUL Class I, Div. 2	

HMI Specifications

Model	Allen Bradley PanelView+ 700 Touch AB #: 2711P-T7C4D1 CUL Class I, Div. 2	Option: Allen Bradley PanelView+ 1000 Touch (AB #: 2711P-T10C4)
Input Power	Max. 2.9A @ 24VDC	
Communications Protocols	Ethernet, RS232-DF1	
Memory	Internal CompactFlash Card	

Unit Number:	**12518**
Customer:	**Husky Oil Operations Ltd.**
Engineer:	**K. Green**
Compressor:	**Ariel RG357M**
Driver:	**3516 (1340HP)**

Notes:
- Revision I/O was added
- Class A-always active, Class b-20s start-up bypass, Class B-120s start-up bypass, Class C-armed once its been seen to be healthy
- PLC internal control tag
- Vibration shutdown setpoints are multiplied by 1.5 during start-up

Legend:
CL - Close
OP - Open
SD - Shutdown
ST - Start
SP - Stop
TD - Time delay shutdown
P - Permissive to start
EN - Energize
DE - De-energize
X - Activate
DX - De-activate
FC - Fail condition
MIN - Minimum Value

REV 3

Revision Date	Rev	Description	Units	Range	Set Point	Tag #											
						Output Description	Engine Run/Stop Command	Engine Start Command	Engine Pre-Lube Pump	Load Solenoid	Unload Solenoid	Vi increase Solenoid	Vi decrease Solenoid	Blowdown Valve	De-Icing Valve	Compressor Pre-Lube Pump	Discharge Valve
						Rev # (Note 1):	0	0	1	1	1	1	1	1	1	1	1
									2010-09-17	2010-09-17	2010-09-17	2010-09-17	2010-09-17	2010-09-17	2010-09-17	2010-09-17	2010-09-17
							UY-RUN/STOP	UY-START	UY-0203	UY-0202A	UY-0202B	UY-0200B	UY-0200A	UY-0200	UY-0207	UY-0204	UY-0202
		Digital Inputs															
	3	PLC Failure	-	-	A	ESD	DE	DE	DE	DE	EN	DE	DE	DE	DE	DE	OP
	0	ESD (Control Panel)	-	-	A	XA-2101	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	V-2 Oil Separator Low Level	-	-	A	LALL-0200	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Low Engine Oil Level	-	-	A	LALL-0201	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Low Turbo water level	-	-	A	LALL-0203	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Low Jacket Water Level	-	-	A	LALL-0202	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Fuel gas scrubber high level	-	-	A	LAHH-0201	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
	0	Engine ignition shutdown (EIS/ADEM3/ESM/Diane)	-	-	A		DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	V-2 Oil Separator High Level	-	-	B	LAHH-0200	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
	2	ESD From Plant PLC (Remote)	-	-	A	XA-2150	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
		Analog Inputs															
2010-09-17	1	Suction Pressure High	kPag	-762mmHg-207kPAg	102 (B)	PAHH-0200	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Suction Pressure Low	kPag	-762mmHg-207kPAg	131 mmHg (A)	PALL-0200	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Suction Pressure Transmitter Failure	kPag	-762mmHg-207kPAg	A	PAXX-0200	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Comp Oil Rotor Inj Pressure Transmitter Failure	kPag	0-2758	A	PAXX-0210	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Comp Oil Rotor Inj Filter ΔP (PT-0210 - PT-0209) High	kPad	0-345	69 (B)	PDAHH-0209	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Comp Oil Rotor Inj Filter ΔP (PT-0210 - PT-0209) Transmitter Failure	kPad	0-345	A	PDAXX-0209	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Comp Oil Pump Pressure High	kPag	0-2758	2047 (A)	PAHH-0204	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Comp Oil Pump Pressure Transmitter Failure	kPag	0-2758	A	PAXX-0204	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Comp Bearing Oil Filter ΔP (PT-0204 - PT-0205) High	kPad	0-345	241 (B)	PDAHH-0205	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Comp Bearing Oil Filter ΔP (PT-0204 - PT-0205) Transmitter Failure	kPad	0-345	A	PDAXX-0205	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Discharge Pressure High	kPag	0-2758	1585 (A)	PAHH-0201	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Discharge Pressure Differential Low	kPag	0-2758	345 (A)	PDALL-0201	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Oil Scavenge Pressure Transmitter Failure	kPag	0-2758	A	PAXX-0208	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Comp Bearing Oil Inj to Scavenge ΔP (PT-0207 - PT-0208) Low	kPad	0-689	310 (B)	PDALL-0208	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Comp Bearing Oil Inj to Scavenge ΔP (PT-0207 - PT-0208) Transmitter Failure	kPad	0-689	A	PDAXX-0208	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Comp Bearing Oil Inj to Scavenge ΔP (PT-0207 - PT-0208) Start Permissive	kPad	0-689	21	PDLA-0208											
2010-09-17	1	Engine Oil Pressure Low	kPag	0-1103	207 (b)	PALL-0212	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Engine Oil Pressure Transmitter Failure	kPag	0-1103	A	PAXX-0212	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Engine Oil Pressure Start Permissive	kPag	0-1103	14	PAL-0212											
2010-09-17	1	Engine Manifold Pressure High	"Hg	-30"Hg-207kPag	39 (A)	PAHH-0216	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Engine Manifold Pressure Transmitter Failure	"Hg	-30"Hg-207kPag	A	PAXX-0216	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Bearing Oil Injection Pressure Transmitter Failure	kPag	0-2068	A	PAXX-0207	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Engine RPM High	RPM	0-2000	1540 (A)	SAHH-0200	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Engine RPM Low	RPM	0-2000	800 (C)	SALL-0200	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Engine RPM Transmitter Failure	RPM	0-2000	A	SAXX-0200	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Slide Valve Position Start Permissive	%	shop	<10	ZAL-0201											
2010-09-17	1	Compressor DE Vibration High	mm/s	0-50	12 (b)	VAHH-0200	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Compressor DE Vibration Transmitter Failure	mm/s	0-50	A	VAXX-0200	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Engine Vibration High	mm/s	0-50	12 (b)	VAHH-0201	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Engine Vibration Transmitter Failure	mm/s	0-50	A	VAXX-0201	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Cooler Vibration High	mm/s	0-50	12 (b)	VAHH-0202	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Cooler Vibration Transmitter Failure	mm/s	0-50	A	VAXX-0202	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
		Temperatures															
2010-09-17	1	Compressor Lube Oil Supply Temp High	°C	100 ohm PT	77 (A)	TAHH-0206	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Compressor Lube Oil Supply Temp Transmitter Failure	°C	100 ohm PT	A	TAXX-0206	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Compressor Lube Oil Supply Temp Start Permissive	°C	100 ohm PT	66	TAL-0206											
2010-09-17	1	Compressor Discharge Temp High	°C	100 ohm PT	119 (A)	TAHH-0201	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Compressor Discharge Temp Transmitter Failure	°C	100 ohm PT	A	TAXX-0201	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Engine Manifold Temp High	°C	100 ohm PT	65 (B)	TAHH-0209	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Engine Manifold Temp Transmitter Failure	°C	100 ohm PT	A	TAXX-0209	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Engine Jacket Water Temp High	°C	100 ohm PT	105 (B)	TAHH-0208	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Engine Jacket Water Temp Transmitter Failure	°C	100 ohm PT	A	TAXX-0208	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Engine oil temp High	°C	100 ohm PT	104 (A)	TAHH-0207	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Engine oil temp Transmitter Failure	°C	100 ohm PT	A	TAXX-0207	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Compressor Suction Temp Low	°C	100 ohm PT	-40 (A)	TALL-0211	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
2010-09-17	1	Compressor Suction Temp Transmitter Failure	°C	100 ohm PT	A	TAXX-0211	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP
	3	Oil Seperator Heater High	℃	Type K	90 (A)	TAHH-0200	DE	DE	X	DE	EN	DE	DE	DE	DE	DE	OP

CSA INTERNATIONAL

Field Certification
Certificate of Compliance

Certificate: **2349880**

Project: **2349880** **Date Issued:** **December 6, 2010**

Issued to: **Enerflex Ltd.**
10121 Barlow Trail NE
Calgary, Alberta, T3J 3C6

Attention: **Mr. Dennis Froese**

The products listed below are eligible to bear CSA Field Certification Labels, bearing the CSA Mark shown

Field Certification

Issued by: Larry DeWald

Authorized by: Gary Boswell
Product Group Manager

PRODUCTS

Part A
CLASS – 9098-01: Miscellaneous – For Hazardous Locations
Electrical features only

CSA Field Certification Labels issued: from serial number FB 488678 to FB 488679

Class I, Division 2, Group D, Temperature Code T2A
Compressor Package, Model: WAUKESHA F18GL/ARIEL

Electrical rating:	Compressor Oil Heater	120 V, 60 Hz, 200 W, 1 Ph
	Engine Oil Heater	120 V, 60 Hz, 200 W, 1 Ph
	Receptacle	120 V, 60 Hz, 15 A, 1 Ph
	Interior Lights	120 V, 60 Hz, 300 W, 1 Ph
	Exterior Lights	120 V, 60 Hz, 140 W, 1 Ph
	Building Heaters	120 V, 60 Hz, 24.2 A, 1 Ph
	Exhaust Fan	120 V, 60 Hz, 4.8 A, 1 Ph
	Panel Power	24 Vdc, 10 A
	Engine Ignition Power	24 Vdc, 10 A
	Discrete	24 Vdc, 1 A
	Analog	24 Vdc, 4 – 20 mA

CSA INTERNATIONAL

Certificate: 2349880

Part B
CLASS – 9098-01: Miscellaneous – For Hazardous Locations
Electrical features only

CSA Field Certification Labels issued: from serial number FB 488680 to FB 488681

Class I, Division 2, Group D, Temperature Code T2A
Compressor Package, Model: CAT G3516LE-AFRC/ARIEL

Electrical rating:	Compressor Oil Heater	480 V, 60 Hz, 23.42 A, 3 Ph
	Oil Separator Heater	480 V, 60 Hz, 3 KW, 3 Ph
	Receptacle	120 V, 60 Hz, 15 A, 1 Ph
	Interior Lights	120 V, 60 Hz, 600 W, 1 Ph
	Exterior Lights	120 V, 60 Hz, 300 W, 1 Ph
	Building Heaters	120 V, 60 Hz, 13.3 A, 1 Ph
	Exhaust Fan	120 V, 60 Hz, 4.8 A, 1 Ph each
	Panel Power	24 Vdc, 10 A
	CAT ADEMIII Power	24 Vdc, 15 A
	Discrete	24 Vdc, 1 A
	Analog	24 Vdc, 4 – 20 mA

APPLICABLE REQUIREMENTS

CSA Standard C22.1-09	-	Canadian Electrical Code Part I.
CSA Standard C22.2 No. 0-M1991	-	General Requirements - Canadian Electrical Code Part II.
CSA Standard C22.2 No. 0.4-04	-	Bonding and Grounding of Electrical Equipment (Protective Grounding)
CSA Standard C22.2 No. 14-10	-	Industrial Control Equipment.
CSA Standard C22.2 No. 213-M1987	-	Non-Incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations.

MARKINGS

An adhesive backed, engraved lamacoid nameplate is secured to the building, permanently marked with the following:

(1) Submitter's name
(2) Model designation
(3) Complete electrical rating
(4) Serial number traceable to month and year of manufacture
(5) Hazardous Location designations
(6) Temperature code

The following cautions and warnings:
(7) WARNING: EXPLOSION HAZARD – DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.
(8) WARNING: EXPLOSION HAZARD – SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIV. 2.

Descriptive and Test Report

CSA INTERNATIONAL

REPORT: 2349880
PROJECT: 2349880

Edition 1: December 6, 2010; Project: 2349880 - Edmonton
Issued by Larry Dewald

Contents:

LOCATION OF EXAMINATION

Enerflex Ltd.
10121 Barlow Trail NE
Calgary, Alberta

PRODUCTS

Part A
CLASS – 9098-01: Miscellaneous – For Hazardous Locations
Electrical features only
Class I, Division 2, Group D, Temperature Code T2A
Compressor Package, Model:

Two (2) only: Compressor Packages, Model: WAUKESHA F18GL/ARIEL, Manufactured by Enerflex Ltd.

Electrical rating:	Compressor Oil Heater	120 V, 60 Hz, 200 W, 1 Ph
	Engine Oil Heater	120 V, 60 Hz, 200 W, 1 Ph
	Receptacle	120 V, 60 Hz, 15 A, 1 Ph
	Interior Lights	120 V, 60 Hz, 300 W, 1 Ph
	Exterior Lights	120 V, 60 Hz, 140 W, 1 Ph
	Building Heaters	120 V, 60 Hz, 24.2 A, 1 Ph
	Exhaust Fan	120 V, 60 Hz, 4.8 A, 1 Ph
	Panel Power	24 Vdc, 10 A
	Engine Ignition Power	24 Vdc, 10 A
	Discrete	24 Vdc, 1 A
	Analog	24 Vdc, 4 – 20 mA

Serial Number	CSA Label Number
31833	FB 488678
31834	FB 488679

Part B
CLASS – 9098-01: Miscellaneous – For Hazardous Locations
Electrical features only
Class I, Division 2, Group D, Temperature Code T2A

Two (2) only: Compressor Packages, Model: CAT G3516LE-AFRC/ARIEL, Manufactured by Enerflex Ltd.

Electrical rating:	Compressor Oil Heater	480 V, 60 Hz, 23.42 A, 3 Ph
	Oil Separator Heater	480 V, 60 Hz, 3 KW, 3 Ph
	Receptacle	120 V, 60 Hz, 15 A, 1 Ph
	Interior Lights	120 V, 60 Hz, 600 W, 1 Ph
	Exterior Lights	120 V, 60 Hz, 300 W, 1 Ph
	Building Heaters	120 V, 60 Hz, 13.3 A, 1 Ph
	Exhaust Fan	120 V, 60 Hz, 4.8 A, 1 Ph each
	Panel Power	24 Vdc, 10 A
	CAT ADEMIII Power	24 Vdc, 15 A
	Discrete	24 Vdc, 1 A
	Analog	24 Vdc, 4 – 20 mA

Serial Number	CSA Label Number
12517	FB 488680
12518	FB 488681

APPLICABLE REQUIREMENTS

CSA Standard C22.1-09	-	Canadian Electrical Code Part I.
CSA Standard C22.2 No. 0-M1991	-	General Requirements - Canadian Electrical Code Part II.
CSA Standard C22.2 No. 0.4-04	-	Bonding and Grounding of Electrical Equipment (Protective Grounding)
CSA Standard C22.2 No. 14-10	-	Industrial Control Equipment.
CSA Standard C22.2 No. 213-M1987	-	Non-Incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations.

MARKINGS

An adhesive backed, engraved lamacoid nameplate is secured to the building, permanently marked with the following:

(1) Submitter's name
(2) Model designation
(3) Complete electrical rating
(4) Serial number traceable to month and year of manufacture
(5) Hazardous Location designations
(6) Temperature code

The following cautions and warnings:
(7) WARNING: EXPLOSION HAZARD – DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.
(8) WARNING: EXPLOSION HAZARD – SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIV. 2.

ALTERATIONS

(1) Markings as above.

FACTORY TESTS

Not applicable

DESCRIPTION

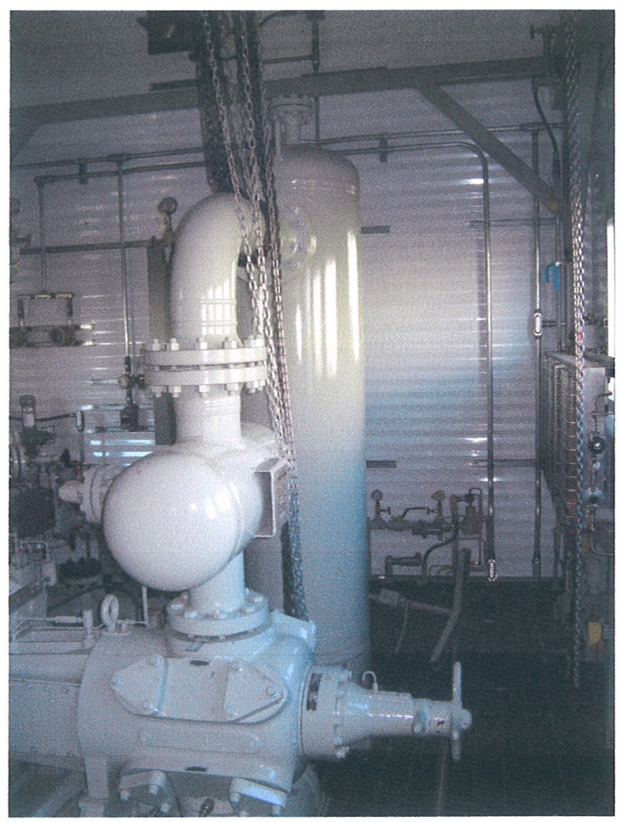
Part A
The Compressor Package consists of a building housing a compressor, control panel, ancillary devices, vessels and associated piping. The building dimensions are 20 feet long by 15.5 feet wide by 14.5 feet high. The cooling section is attached to the end building. The building is equipped with a flame detector, gas detectors, heaters, exhaust fan, lights and receptacles. Three junction boxes mounted on the exterior of the building are provided for field connections. The devices are interconnected to the control panel and junction boxes with rigid conduit complete with sealing fittings and liquid tight flexible conduit installed in compliance with Part 1 of the Canadian Electrical Code. General views are shown following.

Exterior View

Interior View

Interior View

Interior View



Interior View

The major electrical components in the building interior are as follows:

1- Control Panel [Total of 1]
Manufacturer: Enerflex
Model: A/B COMPACT LOGIX
Status: CSA certified, Class I, Division 2, Group C, D, T3
Rating: 24 Vdc, 15 A / 24 Vdc, 10 A
Mounting: Bolted to bracket on the skid.

2- I-P Transducer [Total of 3]
Manufacturer: Fisher
Model: i2P-100
Status: CSA certified, Class I, Division 1, Group A, B, C, D, T5, Seal not required, Single seal
Rating: 30 Vdc, 4 – 20 mA
Mounting: Bolted to a bracket on the skid.

3- Level Switch [Total of 5]
Manufacturer: K-Tek
Model: MS10/15/X/X/BXT1/X/CSX
Status: CSA certified, Class I, Division 1, Group A, B, C, D, T3, Single Seal
Rating: 250 Vac, 1 A / 125 Vdc, 0.5 A
Mounting: Threaded to tank.
Special features: Connected to Non-incendive barrier in control panel.

4- Oil Level Switch [Total of 2]
Manufacturer: FW Murphy
Model: LM301EX
Status: CSA certified, Class I, Division 1, Group C, D
Rating: 250 V, 10 A
Mounting: Bolted to bracket on the engine.
Special features: Connected to Non-incendive barrier in control panel.

5- No Flow Timer [Total of 1]
Manufacturer: Witlock
Model: LED-PS
Status: CSA certified, Class I, Division 1, Group A, B, C, D, T4
Rating: 240 Vdc, 2.5 VA
Mounting: Bolted to bracket on compressor.
Special features: Connected to Non-incendive barrier in control panel.

6- Pressure Transmitter [Total of 7]
Manufacturer: Wika Instruments
Model: E-10
Status: CSA certified, Class I Division 1, Group A, B, C, D, Factory sealed, Single seal
Rating: 10 - 30 Vdc, 4 - 20 mA
Mounting: Bolted to bracket on compressor.

7- Solenoid Valve [Total of 1]
Manufacturer: ASCO
Model: EF8320G202
Status: CSA certified, Class I, Division 1, Group A, B, C, D, 165°C
Rating: 24 Vdc, 11.6 W
Mounting: Bolted to bracket on the skid.

8- Solenoid Valve [Total of 2]
Manufacturer: ASCO
Model: EF8320G231
Status: CSA certified, Class I, Division 1, Group A, B, C, D, 165°C
Rating: 24 Vdc, 11.6 W
Mounting: Bolted to bracket on the skid.

9- Temperature Transmitter [Total of 1]
Manufacturer: Rosemount
Model: 248HAK6U2NS
Status: CSA certified, Class I, Division 1, Groups B, C, D, Seal not required
Rating: 12.4 – 42.4 Vdc, 4 – 20 mA
Mounting: Bolted to bracket on the tank.

10- Thermocouples [Total of 7]
Manufacturer: Thermo-Kinetics
Status: Accepted for use in this application
Rating: K-Type
Mounting: Threaded to tanks and piping.

11- Vibration Transmitter [Total of 3]
Manufacturer: Metrix Instrument
Model: ST5484E-123-020-00
Status: CSA certified, Class I, Division 1, Group B, C, D, Seal not required.
Rating: 11 – 30 Vdc, 4 – 20 mA
Mounting: Threaded in to a junction box bolted to the compressor and motor.

12- Engine Controller [Total of 1]
Manufacturer: Waukesha
Model: 811A
Status: CSA certified, Class I, Division 2, Group D, T4
Rating: 10 - 30 Vdc
Mounting: Bolted to bracket on engine.

13- Ignition Coils [Total of 8]
Manufacturer: WEL
Model: 296460
Status: CSA certified, Class I, Division 1, Group D
Mounting: Bolted to engine.

14- Engine ESD Assembly [Total of 1]
Manufacturer: Waukesha
Special features: Consists of the following components:

14.1- Enclosure [Total of 1]
Manufacturer: Hoffman
Model: A-606CHNF
Status: CSA certified
Rating: Type 4
Mounting: Bolted to bracket on engine.
Special features: Complete with hinged cover

14.2- ESD Button [Total of 1]
Manufacturer: Allen Bradley
Model: 800T-FX
Status: CSA certified, Class I, Division 2, Group A, B, C and D
Rating: 600 V
Mounting: Through machined opening in cover.
Special features: Complete with two Allen Bradley 800T-XAP sealed contact blocks.

14.3- Terminal Blocks [Total of 10]
Manufacturer: Weidmuller
Model: DK 4Q
Status: CSA certified
Rating: 300 V, 10 A
Mounting: Secured to rail screwed to mounting plate.

15- Oil Heater [Total of 2]
Manufacturer: Caloritech.
Model: CXFT102P1X11
Status: CSA certified, Class I, Division 1, Group A, B, C, D
Rating: 120V, 0.2 KW
Mounting: Threaded into oil tanks.

16- Fire Detector [Total of 1]
Manufacturer: Net Safety
Model: UVS-AR
Status: CSA certified, Class I, Division 1, Group B, C, D
Rating: 24 Vdc, 2.65 W
Mounting: Bolted to interior building wall.

17- Fire Detector Junction Box [Total of 1]
Manufacturer: Net Safety
Model: JB-MPR-A
Status: cFM approved, Class I, Division 1, Group B, C, D
Rating: 10 - 30 Vdc, 1.8 W
Mounting: Bolted to interior building wall or bracket on skid.

18- Combustible Gas Detector [Total of 2]
Manufacturer: Net Safety
Model: MLP-AR-SC1100
Status: CSA certified, Class I, Division 1, Group B, C, D, T5
Rating: 10.5 - 32 Vdc, 2.6 W
Mounting: Bolted to interior building wall.

19- Combustible Gas Sensor [Total of 2]
Manufacturer: Net Safety
Model: SC1100
Status: CSA certified, Class I, Division 1, Group B, C, D, T5, Factory Sealed
Rating: 24 Vdc, 300 mA
Mounting: Threaded to junction box.

20- Combustible Gas Sensor Junction Box[Total of 2]
Manufacturer: Net Safety
Model: JB-MFG-A
Status: cFM approved, Class I, Division 1, Group B, C, D
Rating: 10 - 30 Vdc, 1.8 W
Mounting: Bolted to interior building wall or bracket on skid.

21- Interior Lights [Total of 2]
Manufacturer: Crouse Hinds
Model: VMVS150/TT
Status: cUL listed, Class I, Division 2, Group A, B, C, D, T2A
Rating: 120 / 277 / 347 V, 2.0 / 0.9 / 0.5 A
Mounting: Secured to a bracket on the ceiling.

22- Cata-Dyne Heater [Total of 2]
Manufacturer: CCI Thermal Technologies
Model: WX24X72, Series X
Status: CSA certified, Class I, Division 2, Group D, T2C
Rating: 115 V, 24.2 A
Mounting: Bolted to bracket on interior building wall.

23- Exhaust Fan Motor [Total of 1]
Manufacturer: Marathon Electric
Model: JOC 56C17E5314G P
Status: CSA certified, Class I, Division 1, Group C,D, T3B
Rating: 0.25 Horsepower, 115 / 208 – 230 V, 4.8 / 2.3 – 2.4 A, Thermally protected
Mounting: Bolted to bracket on the exhaust fan that is mounted through the building wall.

24- Thermostat [Total of 1]
Manufacturer: Ruffneck
Model: XT-311
Status: CSA certified, Class I, Division 1, Group C, D
Rating: 115 / 230 V, 0.5 / 1 HP, 480 V, 22 A
Mounting: Bolted to single gang box that is bolted a bracket on the interior wall.

25- Receptacle [Total of 2]
Manufacturer: Crouse-Hinds
Model: CPS152R
Status: CSA certified, Class I, Division 1, Group C, D, Factory sealed
Rating: 125 V, 20 A
Mounting: Bolted to single gang box that is bolted to brackets on the interior wall.

26- Pilot Light [Total of 2]
Manufacturer: Cooper Crouse-Hinds
Model: DSD948J1 SA
Status: cUL listed, Class I, Division 1, Group C, D, Factory sealed
Rating: 125 V, 6 W
Mounting: Bolted to single gang box that is bolted a bracket on the interior wall.

27- Switch [Total of 4]
Manufacturer: Cooper Crouse-Hinds
Model: DSFS936
Status: CSA certified, Class I, Division 1, Group B, C, D, Factory sealed
Rating: 120 / 277 V, 20 A
Mounting: Bolted to single gang box that is bolted a bracket on the interior wall.

28- Exhaust Fan Switch [Total of 1]
Manufacturer: Cooper Crouse-Hinds
Model: DSFS910 0 SA
Status: cUL listed, Class I, Division 1, Group C, D, Factory sealed
Rating: 115 / 230 V, 1 HP
Mounting: Bolted to single gang box that is bolted a bracket on the interior wall.

29- HOA Switch [Total of 1]
Manufacturer: Cooper Crouse-Hinds
Model: DSD925 SA
Status: cUL listed, Class I, Division 1, Group C, D, Factory sealed
Rating: 600 V
Mounting: Bolted to single gang box that is bolted a bracket on the interior wall.

The major electrical components on the building exterior are as follows:

30- ESD Button [Total of 2]
Manufacturer: Allen-Bradley
Model: 800T-A operator / 800T-XAP sealed contact block.
Status: CSA certified, Class I, Division 2, Group A, B, C, D
Rating: 600 V, Type 4
Mounting: Secured in Allen-Bradley 800R-1HZ4 type 4 enclosure that is bolted to bracket on the building wall.

31- Exterior Lights [Total of 2]
Manufacturer: Crouse Hinds
Model: VMVS070/TT
Status: cUL listed, Class I, Division 2, Group A, B, C, D, T3
Rating: 120 / 277 / 347 V, 0.8 / 0.4 / 0.3 A
Mounting: Secured to a bracket on the building wall.

32- Junction Box [Total of 3]
Manufacturer: Hoffman
Model: A14128CHQRFG
Status: CSA certified
Rating: Type 4, 4X, 12, 13
Mounting: Bolted to bracket on the building wall.
Special features: Lockable polymer enclosure with internal metal mounting plate. Contains the following components:

32.1- Terminal Block [Total of 36 / 32 / 24]
Manufacturer: Weidmuller
Model: WDU 6
Status: CSA certified
Rating: 600 V, 35 A
Mounting: Secured to rail that is screwed to the internal mounting plate.

32.2- Ground Terminal Block [Total of 2 / 2 / 2]
Manufacturer: Weidmuller
Model: WPE 4
Status: CSA certified
Mounting: Secured to rail that is screwed to the internal mounting plate.

Part B

The Compressor Package consists of a building housing a compressor, control panel, ancillary devices, vessels and associated piping. The building dimensions are 31.3 feet long by 20.75 feet wide by 21.75 feet high. The cooling section is attached to the end building. The building is equipped with a flame detector, gas detectors, heaters, exhaust fan, lights and receptacles. Three junction boxes mounted on the exterior of the building are provided for field connections. The devices are interconnected to the control panel and junction boxes with rigid conduit complete with sealing fittings and liquid tight flexible conduit installed in compliance with Part 1 of the Canadian Electrical Code. General views are shown following.

Exterior View

Interior View

Interior View

Interior View

Interior View

The major electrical components in the building interior are as follows:

1- Control Panel [Total of 1]
Manufacturer: Enerflex
Model: A/B COMPACT LOGIX
Status: CSA certified, Class I, Division 2, Group C, D, T3
Rating: 24 Vdc, 15 A / 24 Vdc, 10 A
Mounting: Bolted to bracket on the skid.

2- I-P Transducer [Total of 1]
Manufacturer: Fisher
Model: i2P-100
Status: CSA certified, Class I, Division 1, Group A, B, C, D, T5, Seal not required, Single seal
Rating: 30 Vdc, 4 – 20 mA
Mounting: Bolted to a bracket on the skid.

3- Level Switch [Total of 5]
Manufacturer: K-Tek
Model: MS10/15/X/X/BXT1/X/CSX
Status: CSA certified, Class I, Division 1, Group A, B, C, D, T3, Single Seal
Rating: 250 Vac, 1 A / 125 Vdc, 0.5 A
Mounting: Threaded to tank.
Special features: Connected to Non-incendive barrier in control panel.

4- Oil Level Switch [Total of 1]
Manufacturer: FW Murphy
Model: LM303EX
Status: CSA certified, Class I, Division 1, Group C, D
Rating: 250 V, 10 A
Mounting: Bolted to bracket on the engine.

5- Pressure Transmitter [Total of 10]
Manufacturer: Wika Instruments
Model: E-10
Status: CSA certified, Class I Division 1, Group A, B, C, D, Factory sealed, Single seal
Rating: 10 - 30 Vdc, 4 - 20 mA
Mounting: Bolted to bracket on compressor.

6- Proximity Sensor [Total of 2]
Manufacturer: Contact Automation Inc.
Model: MADI-X
Status: cQPS certified, Class I, Division 2, Group C, D, T3
Rating: 15 - 30 Vdc, 4 - 20 mA
Mounting: Bolted to bracket on compressor.

7- Solenoid Valve [Total of 5]
Manufacturer: ASCO
Model: EF8320G202
Status: CSA certified, Class I, Division 1, Group A, B, C, D, 165°C
Rating: 24 Vdc, 11.6 W
Mounting: Bolted to bracket on the skid.

8- 2-Way Solenoid Valve [Total of 2]
Manufacturer: Ariel
Model: 001988
Status: CSA certified, non-arcing or sparking, accepted for use in this application
Rating: 24 Vdc, 1.29 A
Mounting: Bolted to bracket on the skid.

9- RTD [Total of 1]
Manufacturer: Wika
Model: TR10
Status: CSA certified, Class I, Division 1, Groups B, C, D
Rating: 30 Vdc max, 20 mA max
Mounting: Threaded in to thermowells in process piping.

10- RTD [Total of 3]
Manufacturer: Wika
Model: RAN-S-14-R-120-2-3-UT-6
Status: Accepted for use in this application, based use in non-incendive circuit.
Rating: RTD
Mounting: Threaded to tanks and piping.

11- Vibration Transmitter [Total of 3]
Manufacturer: Metrix Instrument
Model: ST5484E-123-020-00
Status: CSA certified, Class I, Division 1, Group B, C, D, Seal not required.
Rating: 11 – 30 Vdc, 4 – 20 mA
Mounting: Threaded in to a junction box bolted to the compressor and motor.

12- Engine / Engine Monitoring System [Total of 1]
Manufacturer: Caterpillar
Model: G3516LF-AFRC / G3500 Series
Status: CSA certified, Class I, Division 2, Group C, D, T3
Rating: 24 Vdc, 20 A
Mounting: Bolted to the skid.
Special features: Includes remote Engine Monitoring System panel and engine mounted sensors, ignition and wiring harnesses.

13- Hot Start [Total of 1]
Manufacturer: Kim Hot Start
Model: CLER31804
Status: CSA certified, Class I, Division 1, Group D, T2C
Rating: 480V, 23.42 A
Mounting: Bolted to a bracket on the interior building wall.
Special features: To be directly connected to field wiring.

14- Process Heater [Total of 1]
Manufacturer: Caloritech.
Model: CFXT3033F332X73
Status: CSA certified, Class I, Division 1, Group A, B, C, D
Rating: 480V, 3 KW, 3 Ph
Mounting: Threaded into process vessel.
Special features: To be directly connected to field wiring.

15- Fire Detector [Total of 1]
Manufacturer: Net Safety
Model: UVS-AR
Status: CSA certified, Class I, Division 1, Group B, C, D
Rating: 24 Vdc, 2.65 W
Mounting: Bolted to interior building wall.

16- Fire Detector Junction Box [Total of 1]
Manufacturer: Net Safety
Model: JB-MPR-A
Status: cFM approved, Class I, Division 1, Group B, C, D
Rating: 10 - 30 Vdc, 1.8 W
Mounting: Bolted to interior building wall or bracket on skid.

17- Combustible Gas Detector [Total of 2]
Manufacturer: Net Safety
Model: MLP-AR-SC1100
Status: CSA certified, Class I, Division 1, Group B, C, D, T5
Rating: 10.5 - 32 Vdc, 2.6 W
Mounting: Bolted to interior building wall.

18- Combustible Gas Sensor [Total of 2]
Manufacturer: Net Safety
Model: SC1100
Status: CSA certified, Class I, Division 1, Group B, C, D, T5, Factory Sealed
Rating: 24 Vdc, 300 mA
Mounting: Threaded to junction box.

19- Combustible Gas Sensor Junction Box[Total of 2]
Manufacturer: Net Safety
Model: JB-MFG-A
Status: cFM approved, Class I, Division 1, Group B, C, D
Rating: 10 - 30 Vdc, 1.8 W
Mounting: Bolted to interior building wall or bracket on skid.

20- Interior Lights [Total of 4]
Manufacturer: Crouse Hinds
Model: VMVS150/TT
Status: cUL listed, Class I, Division 2, Group A, B, C, D, T2A
Rating: 120 / 277 / 347 V, 2.0 / 0.9 / 0.5 A
Mounting: Secured to a bracket on the ceiling.

21- Cata-Dyne Heater [Total of 3]
Manufacturer: CCI Thermal Technologies
Model: MKII 2448, Series X
Status: CSA certified, Class I, Division 2, Group D, T2C
Rating: 115 V, 13.3 A
Mounting: Bolted to bracket on interior building wall.

22- Exhaust Fan Motor [Total of 3]
Manufacturer: Marathon Electric
Model: JOC 56C17E5314G P
Status: CSA certified, Class I, Division 1, Group C, D, T3B
Rating: 0.25 Horsepower, 115 / 208 – 230 V, 4.8 / 2.3 – 2.4 A, Thermally protected
Mounting: Bolted to bracket on the exhaust fan that is mounted through the building wall.

23- Thermostat [Total of 3]
Manufacturer: Ruffneck
Model: XT-311
Status: CSA certified, Class I, Division 1, Group C, D
Rating: 115 / 230 V, 0.5 / 1 HP, 480 V, 22 A
Mounting: Bolted to single gang box that is bolted a bracket on the interior wall.

24- Receptacle [Total of 2]
Manufacturer: Crouse-Hinds
Model: CPS152R
Status: CSA certified, Class I, Division 1, Group C, D, Factory sealed
Rating: 125 V, 20 A
Mounting: Bolted to single gang box that is bolted to brackets on the interior wall.

25- Pilot Light [Total of 3]
Manufacturer: Cooper Crouse-Hinds
Model: DSD948J1 SA
Status: cUL listed, Class I, Division 1, Group C, D, Factory sealed
Rating: 125 V, 6 W
Mounting: Bolted to single gang box that is bolted a bracket on the interior wall.

26- Switch [Total of 5]
Manufacturer: Cooper Crouse-Hinds
Model: DSFS936
Status: CSA certified, Class I, Division 1, Group B, C, D, Factory sealed
Rating: 120 / 277 V, 20 A
Mounting: Bolted to single gang box that is bolted a bracket on the interior wall.

27- Exhaust Fan Switch [Total of 3]
Manufacturer: Cooper Crouse-Hinds
Model: DSFS910 0 SA
Status: cUL listed, Class I, Division 1, Group C, D, Factory sealed
Rating: 115 / 230 V, 1 HP
Mounting: Bolted to single gang box that is bolted a bracket on the interior wall.

28- HOA Switch [Total of 3]
Manufacturer: Cooper Crouse-Hinds
Model: DSD925 SA
Status: cUL listed, Class I, Division 1, Group C, D, Factory sealed
Rating: 600 V
Mounting: Bolted to single gang box that is bolted a bracket on the interior wall.

The major electrical components on the building exterior are as follows:

29- ESD Button [Total of 2]
Manufacturer: Allen-Bradley
Model: 800T-A operator / 800T-XAP sealed contact block.
Status: CSA certified, Class I, Division 2, Group A, B, C, D
Rating: 600 V, Type 4
Mounting: Secured in Allen-Bradley 800R-1HZ4 type 4 enclosure that is bolted to bracket on the building wall.

30- Exterior Lights [Total of 2]
Manufacturer: Crouse Hinds
Model: VMVS150/TT
Status: cUL listed, Class I, Division 2, Group A, B, C, D, T2A
Rating: 120 / 277 / 347 V, 2.0 / 0.9 / 0.5 A
Mounting: Secured to a bracket on the building wall.

31- Junction Box [Total of 3]
Manufacturer: Hoffman
Model: A14128CHQRFG
Status: CSA certified
Rating: Type 4, 4X, 12, 13
Mounting: Bolted to bracket on the building wall.
Special features: Lockable polymer enclosure with internal metal mounting plate. Contains the following components:

31.1- Terminal Block [Total of 36 / 32 / 24]
Manufacturer: Weidmuller
Model: WDU 6
Status: CSA certified
Rating: 600 V, 35 A
Mounting: Secured to rail that is screwed to the internal mounting plate.

31.2- Ground Terminal Block [Total of 2 / 2 / 2]
Manufacturer: Weidmuller
Model: WPE 4
Status: CSA certified
Mounting: Secured to rail that is screwed to the internal mounting plate.

NOTES

(1) The product has been investigated for electrical features only. The mechanical features are not part of this evaluation

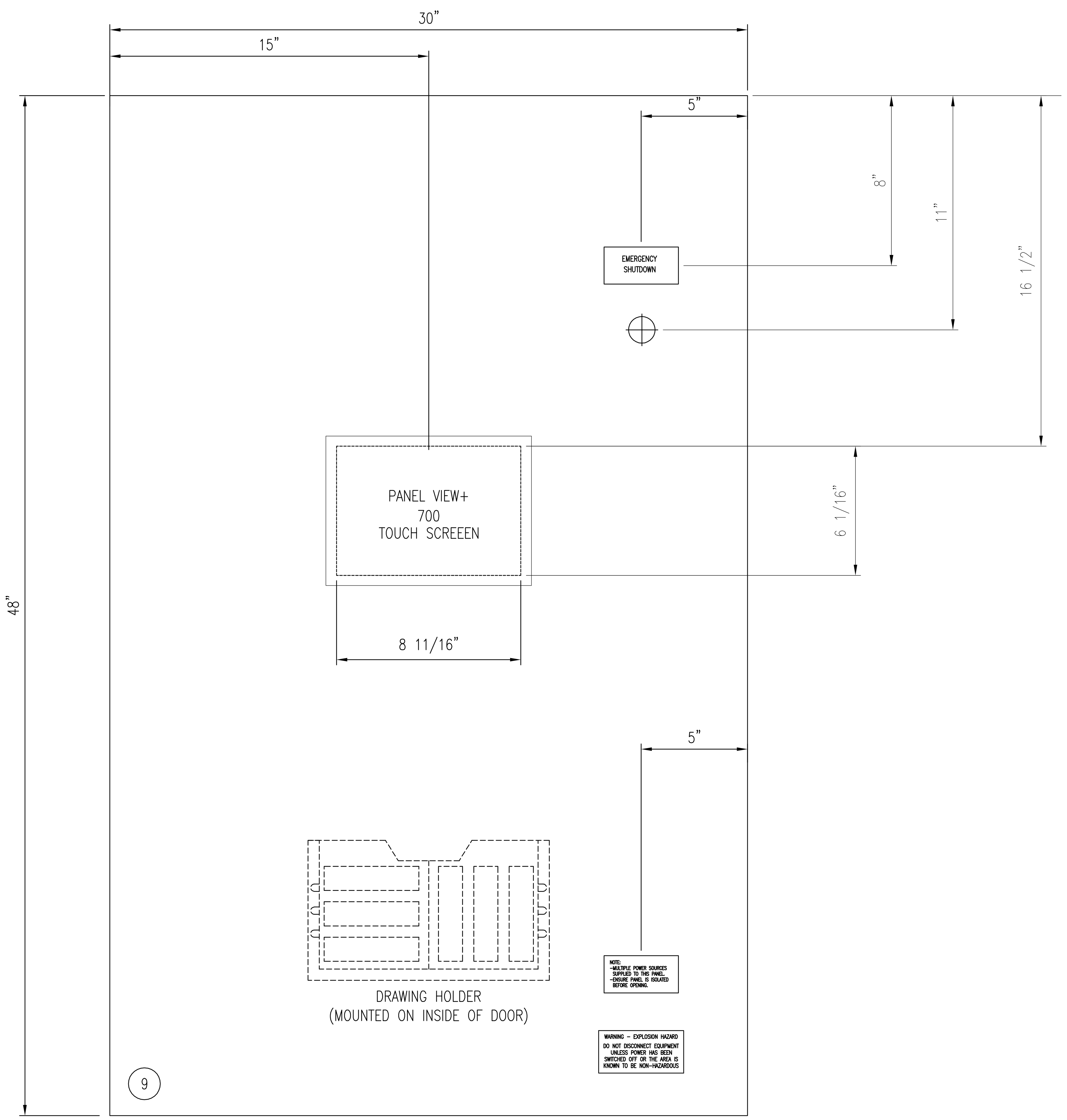
TEST REPORT

Dielectric withstand tests as required in C22.2 No. 14-05 Clause 6.8 were performed by the submitter as per their certified product covered under CSA file LR 231688. The submitter's Confirmation of Dielectric-Strength Testing reports are retained in CSA file 2349880 at CSA Edmonton facility.

Temperature Code Rating, C22.2 No. 213, Clause 6.2. – Temperature tests were waived as unit is an assembly of certified components. The temperature code is based on the marked rating on the hottest component.

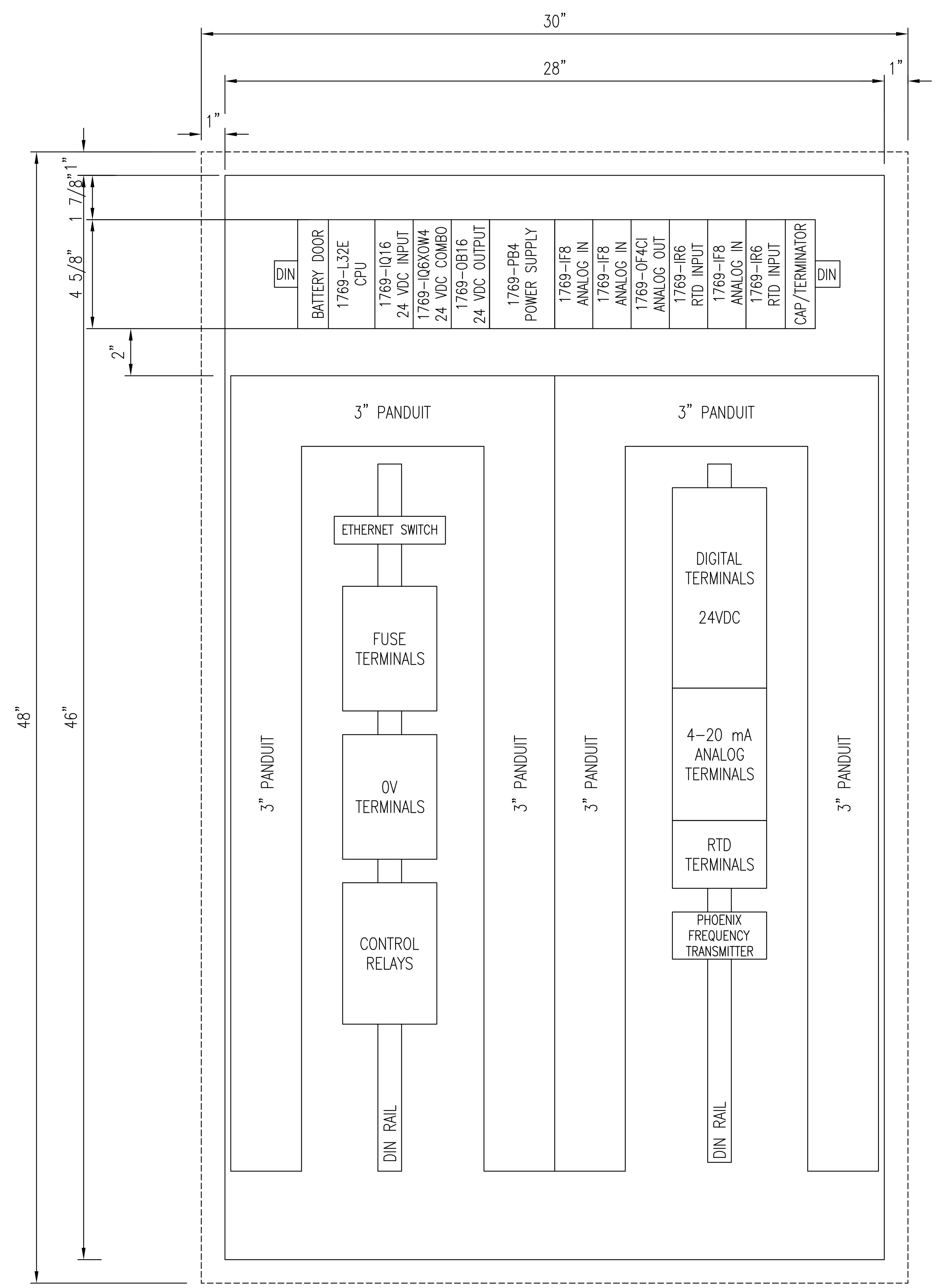
No further tests considered necessary.

End of Report

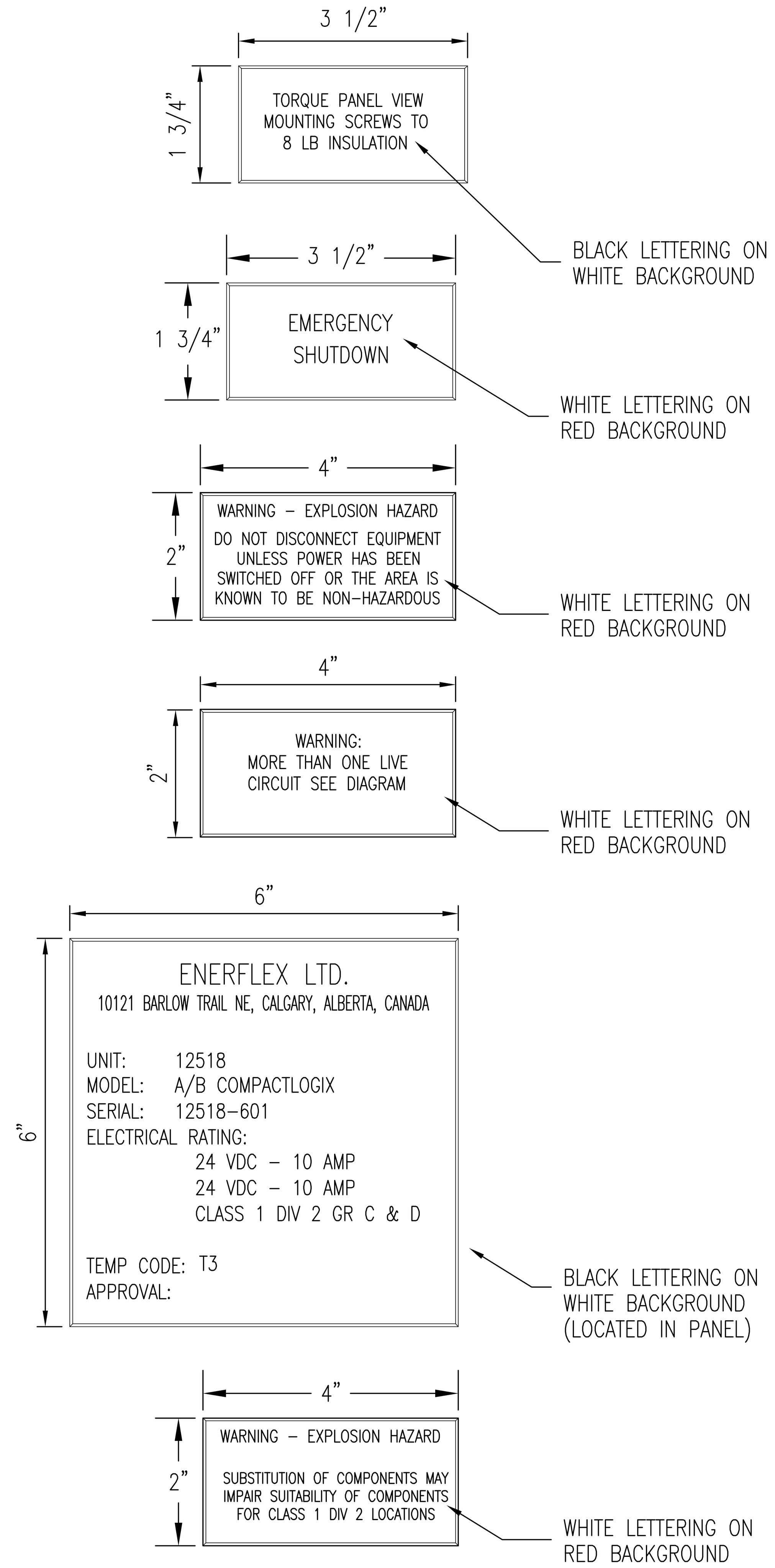


DOOR LAYOUT

PLC ENCLOSURE, NEMA4
EUROBEX 5412ES483010



BACK PANEL LAYOUT



LAMICOID DETAILS

REV.	DESCRIPTION	DATE	BY	APPR.
5	AS BUILT	DEC 10/10	YK	TK
4	THERMOCOUPLE CARD REMOVED, ADDITION ON PAGE 5	OCT 05/10	YK	TO
3	TAG CHANGE	SEP 23/10	YK	TK
2	REVISION	SEPT 8/10	YK	GM
1	ISSUED FOR CONSTRUCTION	AUG 16/10	YK	GM

ENGINEER STAMP

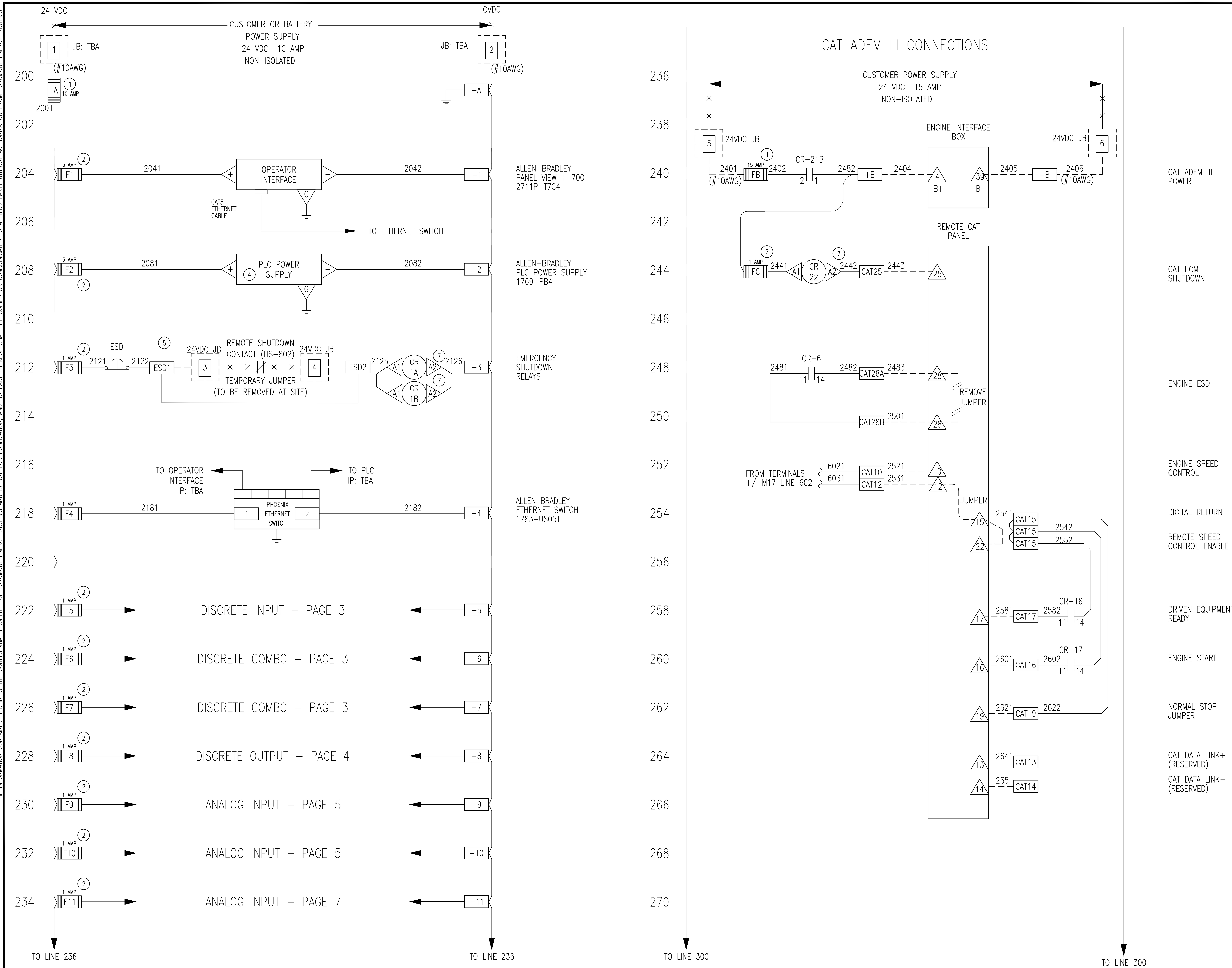
ENERFLEX

TITLE: CONTROL PANEL SCHEMATIC

FOR: TESI UNIT #12518
HUSKY OIL OPERATIONS
CATERPILLAR G3516LE-AFRC/ARIEL RG357M
BOOSTER COMPRESSOR

DRAWN BY: T. TOCHER	DATE: DEC 22, 2009
CHKD. BY: G. McLEAN	SCALE: N.T.S.
APPR. BY: G. McLEAN	W.O. No: 12518-151
CUST. PO No:	

DWG. No: 12518-601 | SHEET No: 1 OF 7 | REV: 5



LEGEND

WIRING DESCRIPTION

- CONTROL PANEL WIRING BY ENERFLEX LTD.
- SKID WIRING BY ENERFLEX LTD.
- WIRING BY OTHERS
- TERMINAL INTERCONNECTING STRIP

- SKID WIRING TO BE STRANDED COPPER #14 AWG T-90.
- PANEL WIRING TO BE STRANDED COPPER #18 AWG TEW.
- 4 TO 20 mA ANALOG CABLE BELDEN 8760 1 PAIR 18 AWG/TWISTED/SHIELDED/BLACK & WHITE
- THERMOCOUPLES TO BE WIRED USING THERMOCOUPLE EXTENSION WIRE
- RTD/POTENTIOMETER ANALOG CABLE BELDEN 8770 3 CONDUCTOR 18 AWG/TWISTED/SHIELDED/BLACK, RED AND WHITE.
- CONTROL PANEL WIRING COLOUR CODING :
  D/C POSITIVE - WHITE D/C LOGIC - WHITE
  D/C NEGATIVE - BLACK GROUND - GREEN
- CONNECT ALL INSTRUMENT GROUNDS TO THE INSTRUMENT GROUND BAR.

TERMINAL AND ITEM DESCRIPTION

- TERMINALS ON TERMINAL STRIP IN THE CONTROL PANEL
- X AMP FX — FUSE TERMINALS ON TERMINAL STRIP IN THE CONTROL PANEL
- TERMINALS ON EQUIPMENT
- BOM REFERENCE NUMBERS

F - 24 VDC POSITIVE FUSE
G - INSTRUMENT GROUND
+M, -M } 4-20 MA LOOP
T - TEMPERATURE ELEMENT
Z - POTENTIOMETER
HS - HAND SWITCH
CR - CONTROL RELAY

TERMINAL SPECIFICATIONS

- TERMINALS T1 TO T18 ARE WEIDMULLER TYPE WDU 2.5N CAT. NO. 104080
- TERMINAL -A , +B, AND -B ARE WDU10 CAT. NO. 102030; ALL OTHER 0V TERMINALS ARE WEIDMULLER TYPE WDU 4N CAT. NO. 104260
- TERMINALS ARE WEIDMULLER TYPE WDK 2.5N CAT. NO. 104160 UNLESS OTHERWISE NOTED
- NOTE1: CR21A + CR21B ARE PROVIDED FOR BATTERY POWERED UNITS ONLY

REV.	DESCRIPTION	DATE	BY	APPR.
5	AS BUILT	DEC 10/10	YK	TK
4	THERMOCOUPLE CARD REMOVED, ADDITION ON PAGE 5	OCT 05/10	YK	TO
3	TAG CHANGE	SEP 23/10	YK	TK
2	REVISION	SEPT 8/10	YK	GM
1	ISSUED FOR CONSTRUCTION	AUG 16/10	YK	GM

ENGINEER STAMP

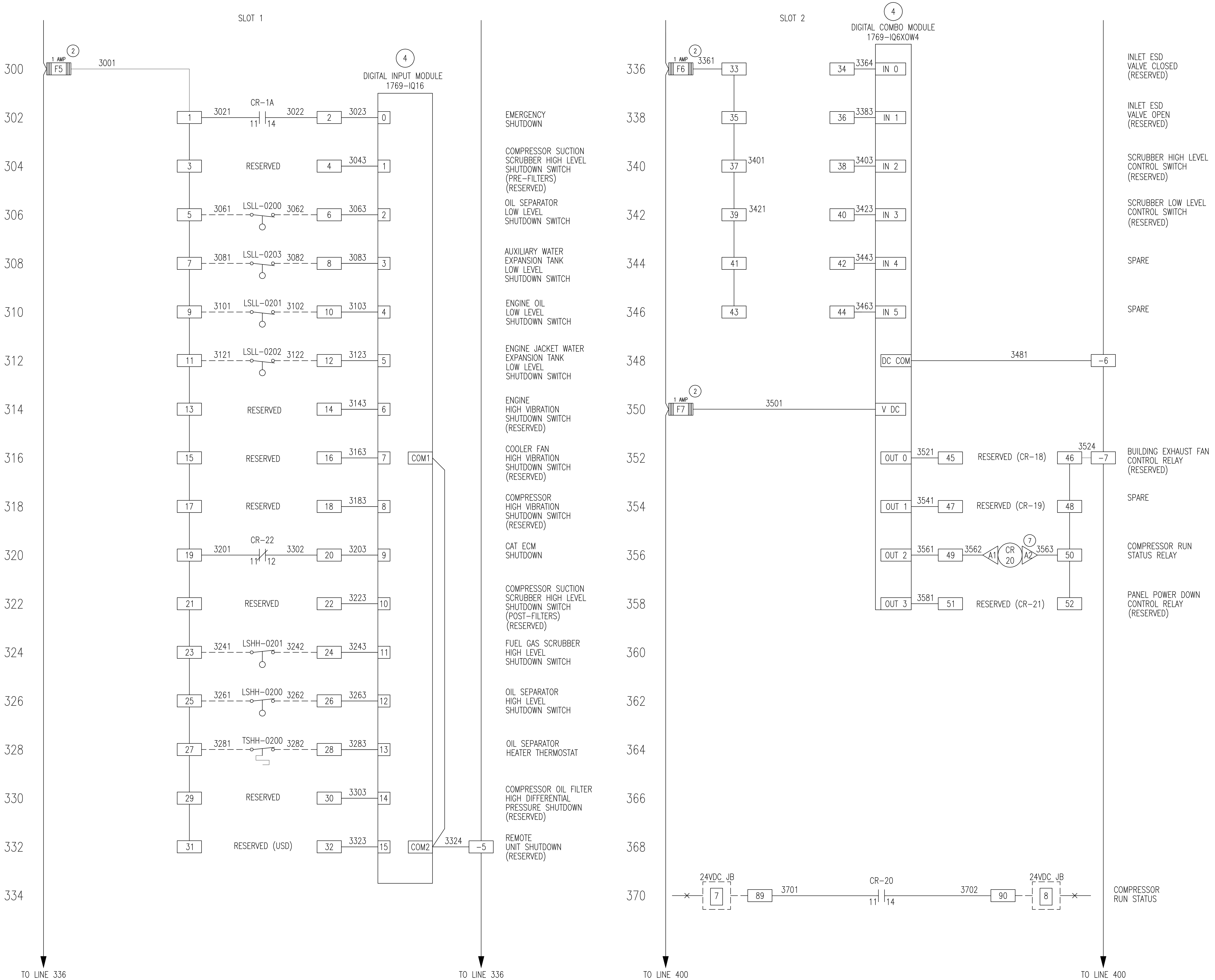
ENERFLEX

TITLE: CONTROL PANEL SCHEMATIC

FOR: TESI UNIT #12518
HUSKY OIL OPERATIONS
CATERPILLAR G3516LE-AFRC/ARIEL RG357M
BOOSTER COMPRESSOR

DRAWN BY: T. TOCHER	DATE: DEC 22, 2009
CHKD. BY: G. McLEAN	SCALE: N.T.S.
APPR. BY: G. McLEAN	W.O. No: 12518-151
CUST. PO No:	

DWG. No: 12518-601 SHEET No: 2 OF 7 REV: 5



NOTE:
REMOVE CR-21 IF PANEL IS NOT BATTERY POWERED

REV.	DESCRIPTION	DATE	BY	APPR.
5	AS BUILT	DEC 10/10	YK	TK
4	THERMOCOUPLE CARD REMOVED, ADDITION ON PAGE 5	OCT 05/10	YK	TO
3	TAG CHANGE	SEP 23/10	YK	TK
2	REVISION	SEPT 8/10	YK	GM
1	ISSUED FOR CONSTRUCTION	AUG 16/10	YK	GM

ENGINEER STAMP

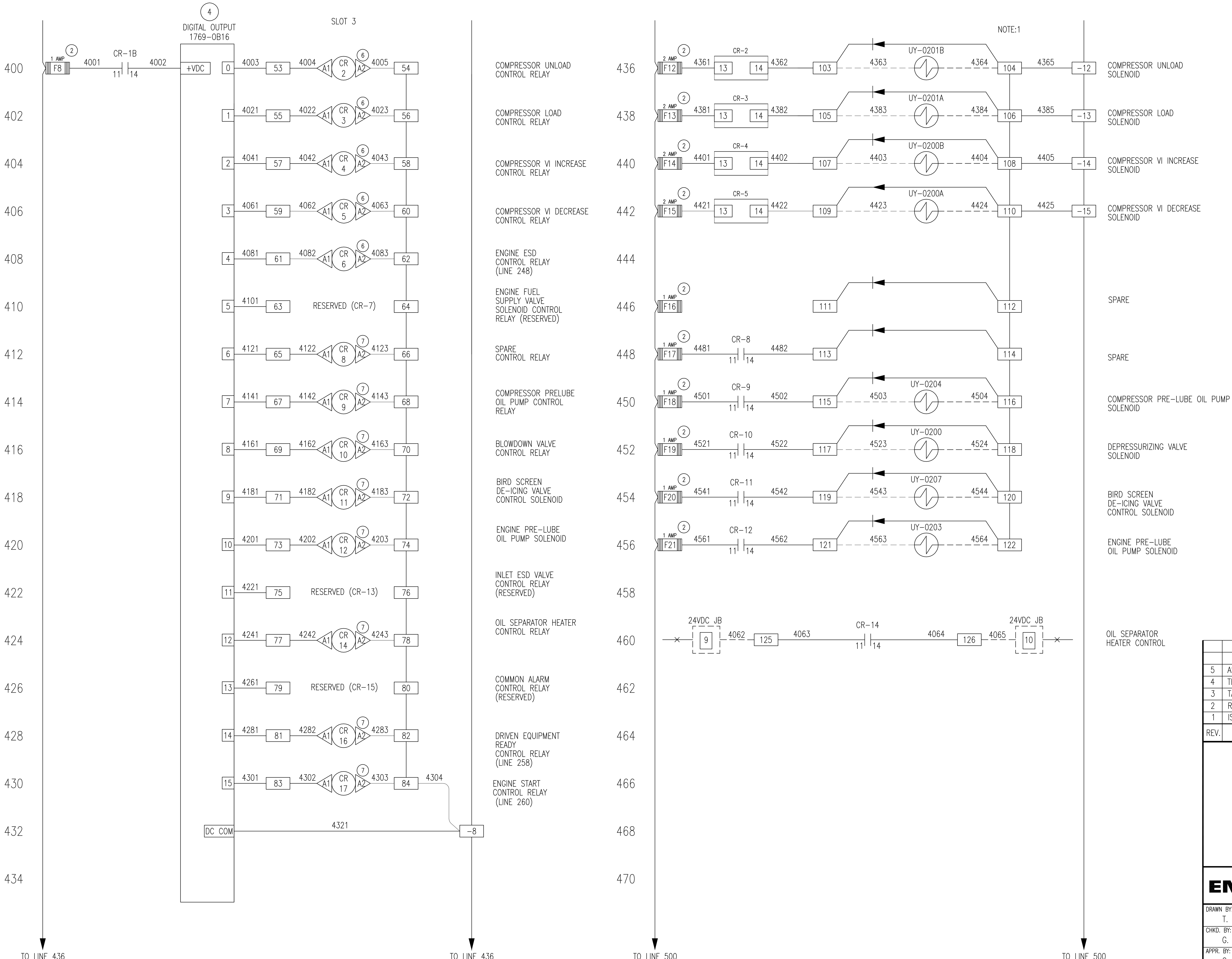
ENERFLEX

TITLE: CONTROL PANEL SCHEMATIC

FOR: TESI UNIT #12518
HUSKY OIL OPERATIONS
CATERPILLAR G3516LE-AFRC/ARIEL RG357M
BOOSTER COMPRESSOR

DRAWN BY: T. TOCHER	DATE: DEC 22, 2009
CHKD. BY: G. McLEAN	SCALE: N.T.S.
APPR. BY: G. McLEAN	W.O. No: 12518-151
CUST. PO No:	

DWG. No: 12518-601 SHEET No: 3 OF 7 REV: 5



NOTE:1 TERMINALS 103 TO 122 ARE WEIDMULLER TYPE WDK 2.5D CAT. NO. 102340

REV.	DESCRIPTION	DATE	BY	APPR.
5	AS BUILT	DEC 10/10	YK	TK
4	THERMOCOUPLE CARD REMOVED, ADDITION ON PAGE 5	OCT 05/10	YK	TO
3	TAG CHANGE	SEP 23/10	YK	TK
2	REVISION	SEPT 8/10	YK	GM
1	ISSUED FOR CONSTRUCTION	AUG 16/10	YK	GM

ENGINEER STAMP

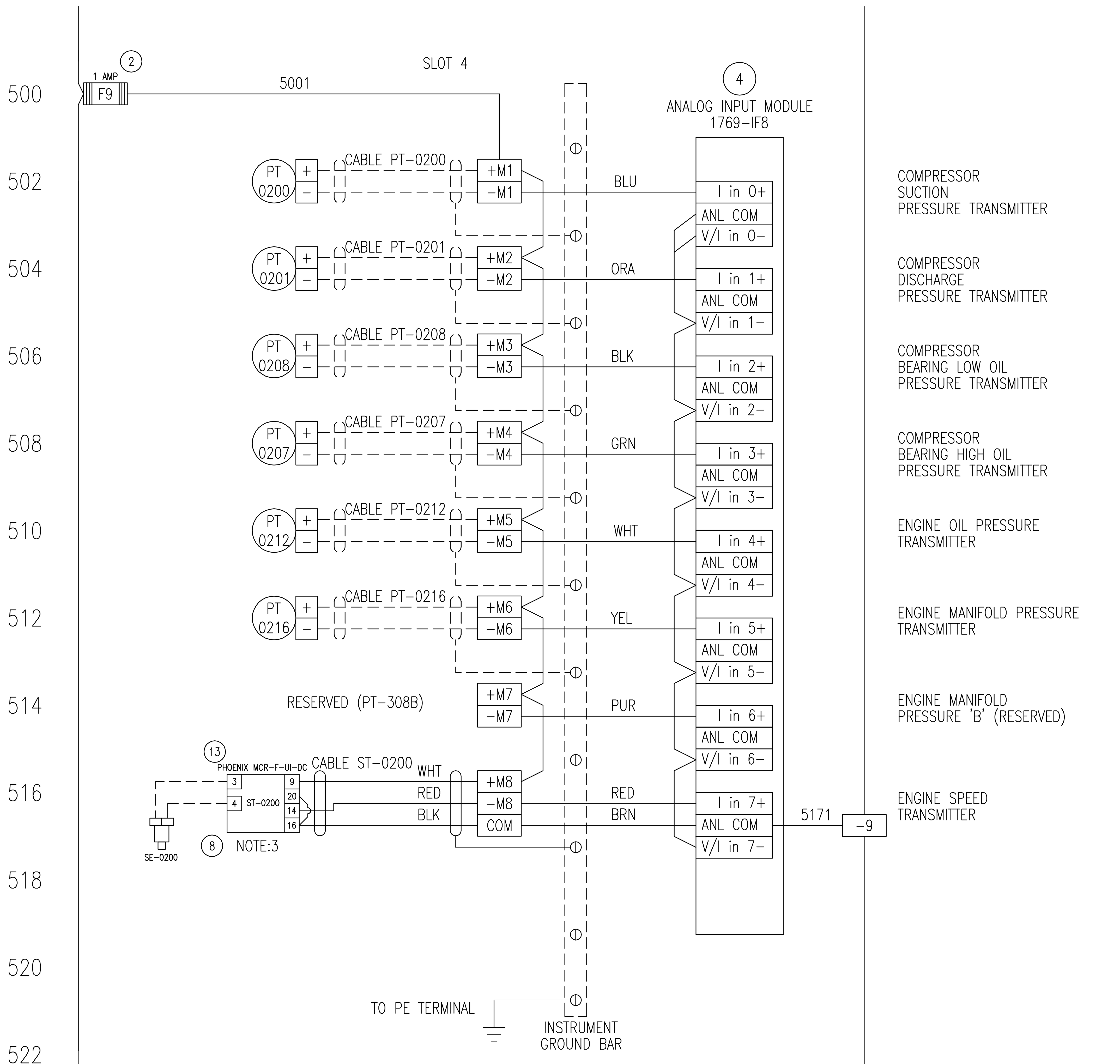
ENERFLEX

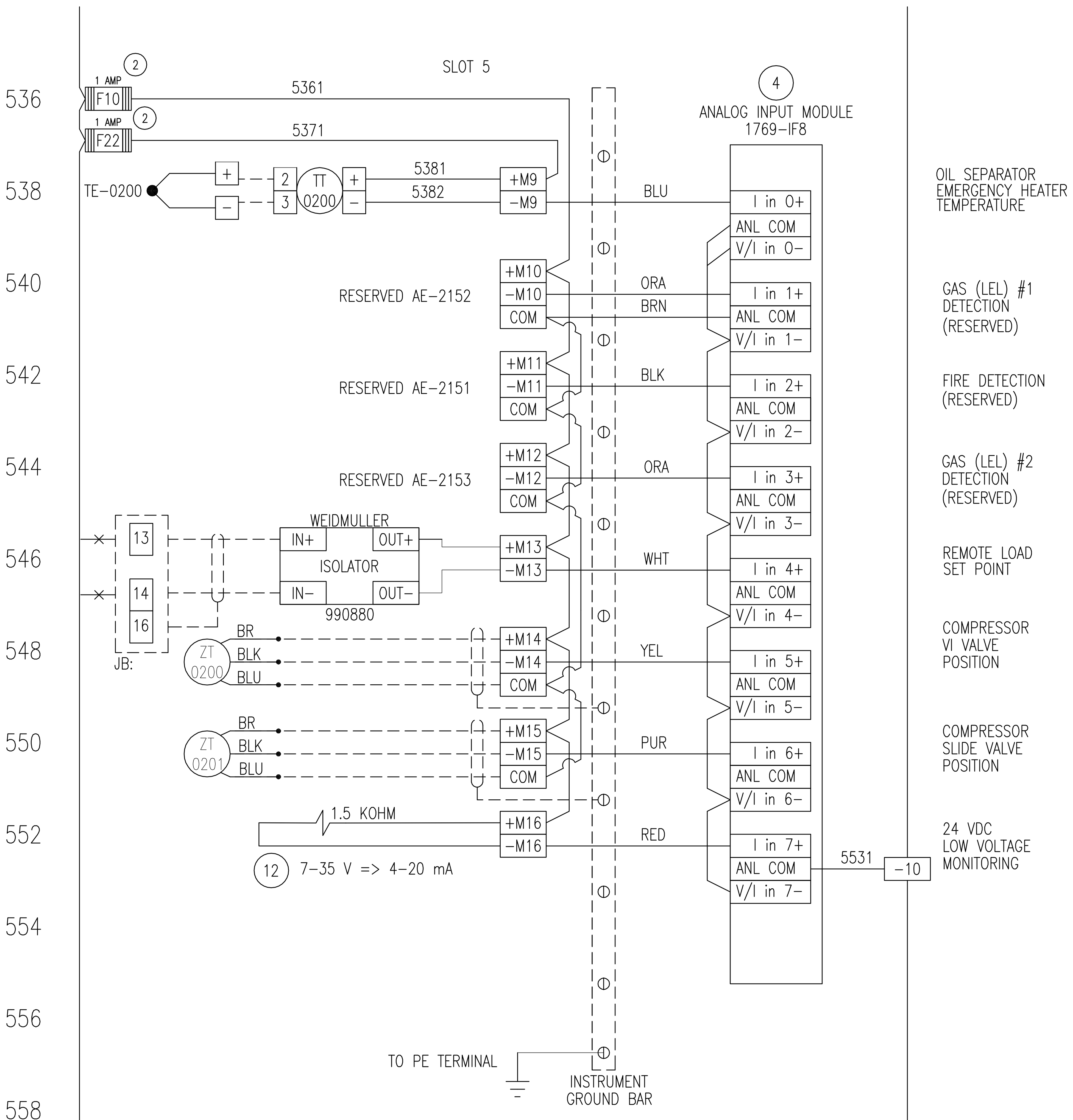
TITLE: CONTROL PANEL SCHEMATIC

FOR: TESI UNIT #12518
HUSKY OIL OPERATIONS
CATERPILLAR G3516LE-AFRC/ARIEL RG357M
BOOSTER COMPRESSOR

DRAWN BY: T. TOCHER	DATE: DEC 22, 2009
CHKD. BY: G. McLEAN	SCALE: N.T.S.
APPR. BY: G. McLEAN	W.O. No: 12518-151
CUST. PO No:	

DWG. No: 12518-601 SHEET No: 4 OF 7 REV: 5





NOTE:1 COM TERMINALS ARE PROVIDED FOR 3 WIRE TRANSMITTERS

NOTE:3 SPEED TRANSMITTER CALIBRATION

ENGINE	TEETH	FREQ @ 2000 RPM (Hz)
CAT-3406	113	3767
CAT-3512	183	6100
CAT-3516	183	6100
CAT-3600S	255	8500
WAUK-F18GL	150	5000
WAUK-H24GL	150	5000
WAUK-7042GL	208	6933
WAUK-7044GSI	208	6933

REV.	DESCRIPTION	DATE	BY	APPR.
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4	THERMOCOUPLE CARD REMOVED, ADDITION ON PAGE 5	OCT 05/10	YK	TO
3	TAG CHANGE	SEP 23/10	YK	TK
2	REVISION	SEPT 8/10	YK	GM
1	ISSUED FOR CONSTRUCTION	AUG 16/10	YK	GM

ENGINEER STAMP

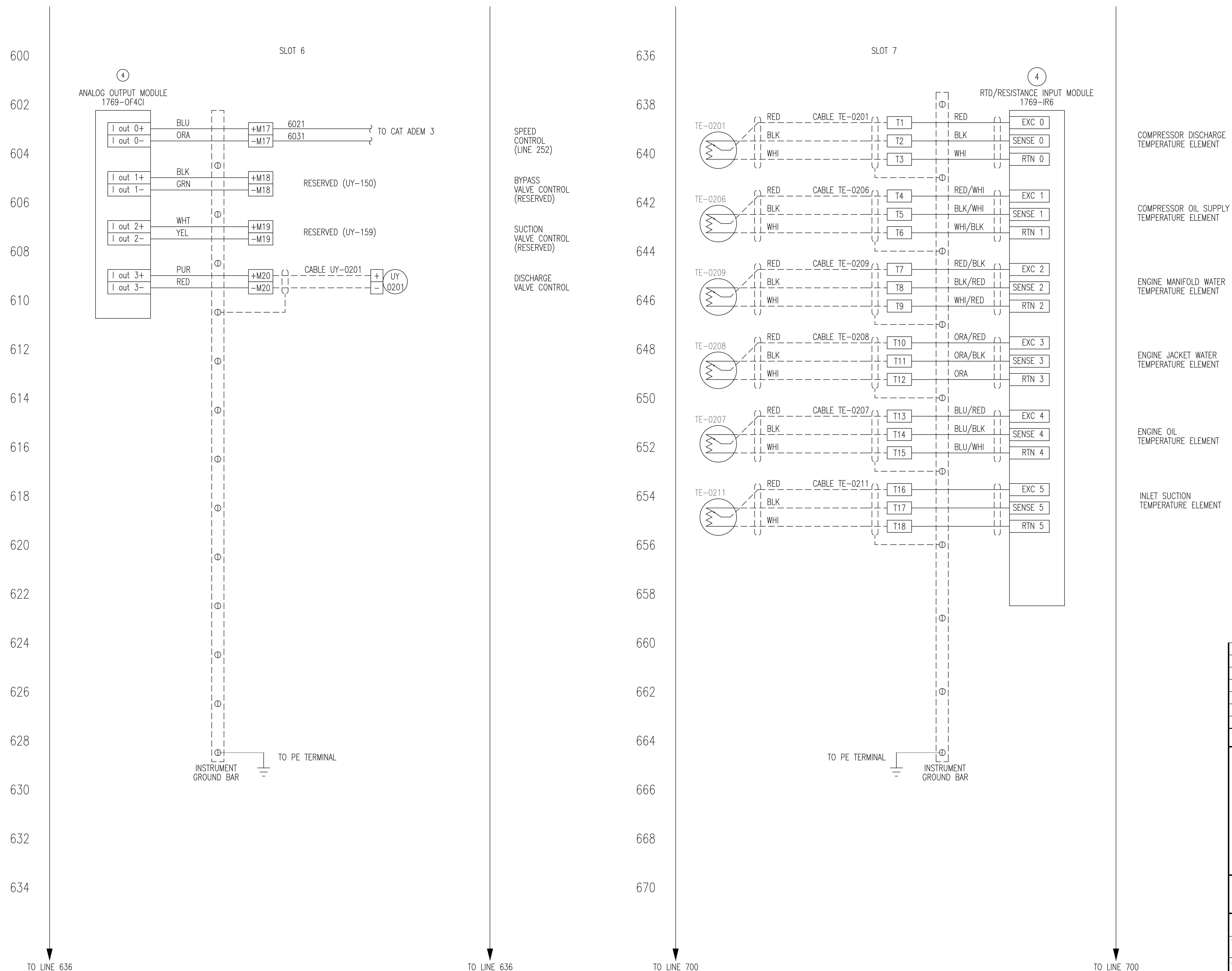
ENERFLEX

TITLE: CONTROL PANEL SCHEMATIC

FOR: TESI UNIT #12518
HUSKY OIL OPERATIONS
CATERPILLAR G3516LE-AFRC/ARIEL RG357M
BOOSTER COMPRESSOR

DRAWN BY: T. TOCHER	DATE: DEC 22, 2009
CHKD. BY: G. McLEAN	SCALE: N.T.S.
APPR. BY: G. McLEAN	W.O. No: 12518-151
CUST. PO No:	

DWG. No: 12518-601 SHEET No: 5 OF 7 REV: 5



REV.	DESCRIPTION	DATE	BY	APPR.
5	AS BUILT	DEC 10/10	YK	TK
4	THERMOCOUPLE CARD REMOVED, ADDITION ON PAGE 5	OCT 05/10	YK	TO
3	TAG CHANGE	SEP 23/10	YK	TK
2	REVISION	SEPT 8/10	YK	GM
1	ISSUED FOR CONSTRUCTION	AUG 16/10	YK	GM

ENGINEER STAMP

ENERFLEX

TITLE: CONTROL PANEL SCHEMATIC

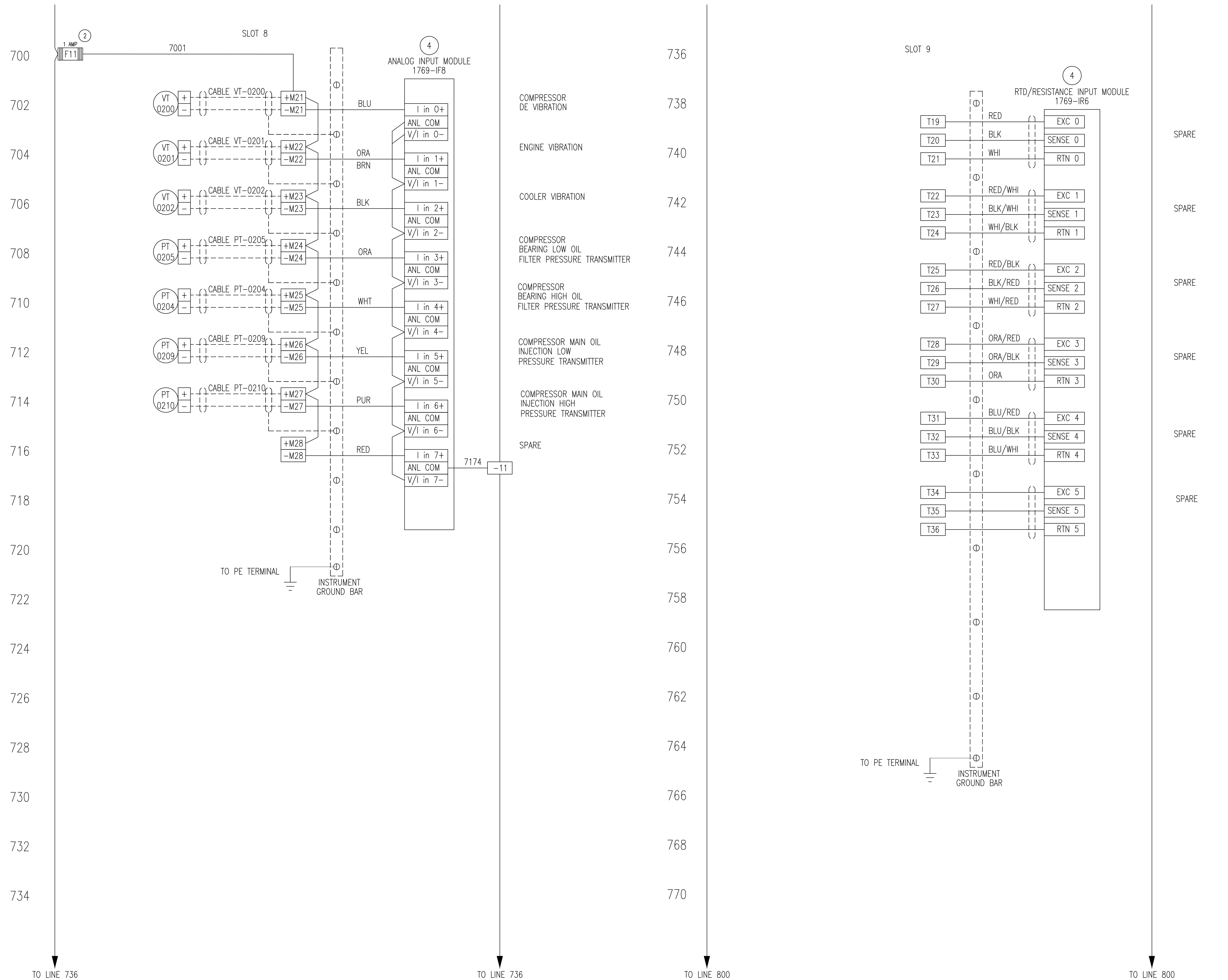
FOR:
TESI UNIT #12518
HUSKY OIL OPERATIONS
CATERPILLAR G3516LE-AFRC/ARIEL RG357M
BOOSTER COMPRESSOR

DRAWN BY: T. TOCHER	DATE: DEC 22, 2009
CHKD. BY: G. McLEAN	SCALE: N.T.S.
APPR. BY: G. McLEAN	W.O. No: 12518-151
CUST. PO No:	

DWG. No: 12518-601

SHEET No: 6 OF 7

REV: 5



REV.	DESCRIPTION	DATE	BY	APPR.
5	AS BUILT	DEC 10/10	YK	TK
4	THERMOCOUPLE CARD REMOVED, ADDITION ON PAGE 5	OCT 05/10	YK	TO
3	TAG CHANGE	SEP 23/10	YK	TK
2	REVISION	SEPT 8/10	YK	GM
1	ISSUED FOR CONSTRUCTION	AUG 16/10	YK	GM

ENGINEER STAMP

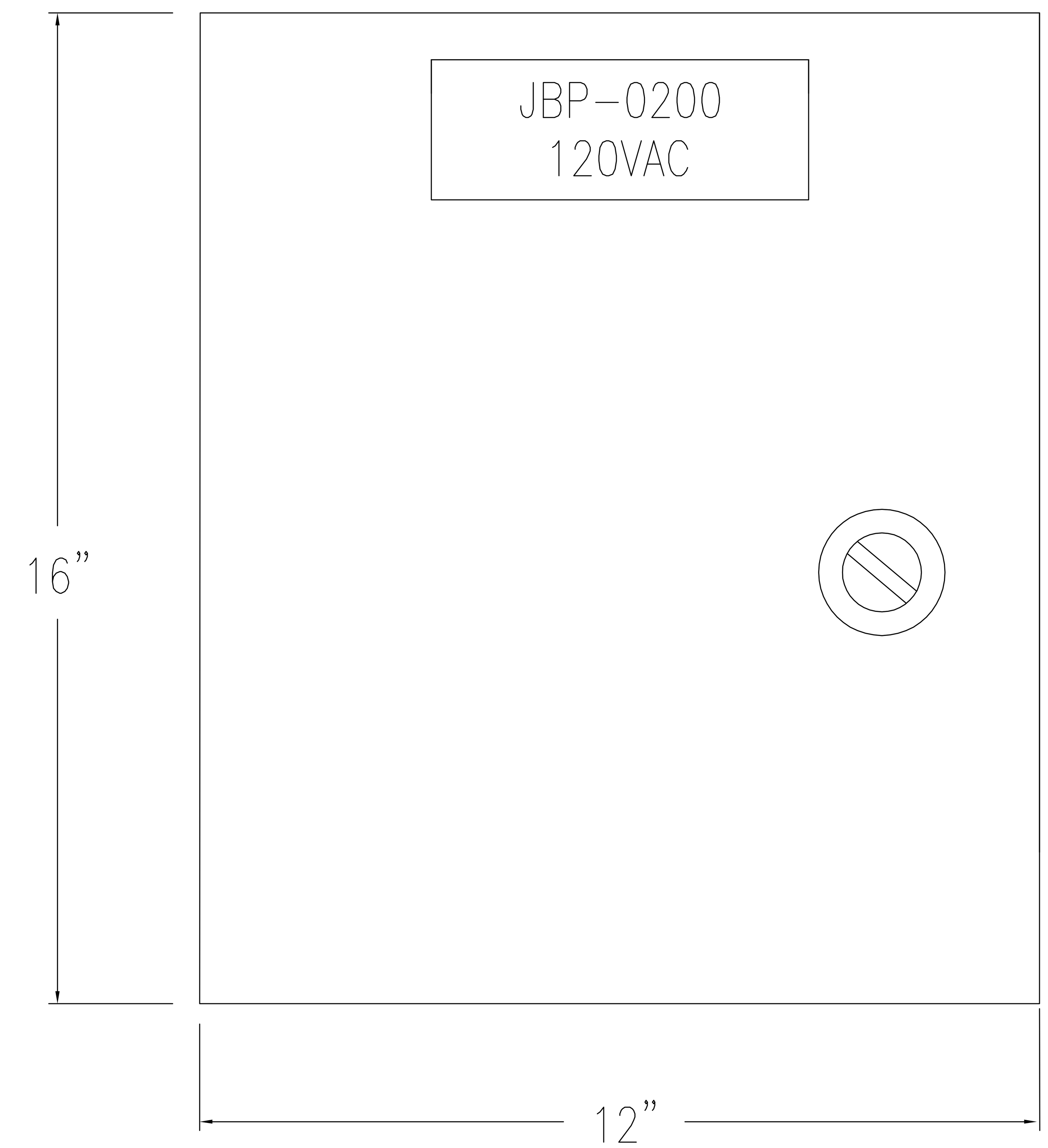
ENERFLEX

TITLE: CONTROL PANEL SCHEMATIC

FOR: TESI UNIT #12518
HUSKY OIL OPERATIONS
CATERPILLAR G3516LE-AFRC/ARIEL RG357M
BOOSTER COMPRESSOR

DRAWN BY: T. TOCHER	DATE: DEC 22, 2009
CHKD. BY: G. McLEAN	SCALE: N.T.S.
APPR. BY: G. McLEAN	W.O. No: 12518-151
CUST. PO No:	

DWG. No: 12518-601 SHEET No: 7 OF 7 REV: 5



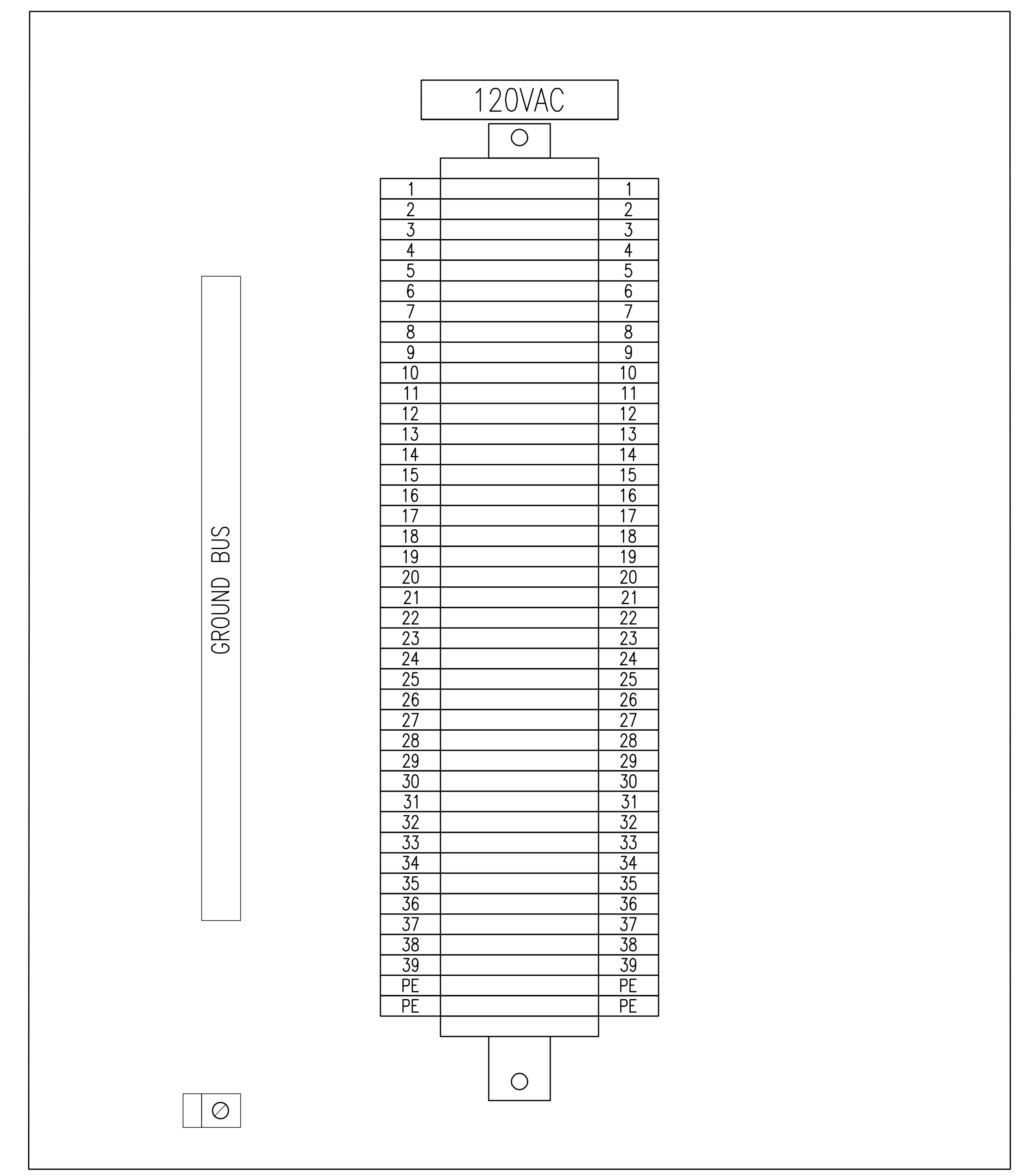
DOOR LAYOUT

NEMA4 ENCLOSURE 16 X 12 X 6"
HOFFMAN A14128CHQRFG

NOTE: ALL CABLE, CONDUCT CONNECTIONS
FROM BOTTOM OF THE JB

NOTE: INCLUDES BREATHER/DRAIN
CROUSE HINDS ECD18

NOTE: MOUNT JB SO BOTTOM
IS 18" ABOVE SKID FLOOR



BACK PANEL LAYOUT

REV.	DESCRIPTION	DATE	BY	APPR.
4	AS BUILT	DEC 10/10	YK	TK
3	REVISION – WIRING CHANGE	OCT 25/10	YK	TO
2	REVISION – CONNECTION CHANGE PG 2	OCT 5/10	YK	CH
1	ISSUED FOR CONSTRUCTION	AUG 26/10	YK	GM

PERMIT TO PRACTICE STAMP

ENGINEER STAMP

ENERFLEX

DRAWN BY: T.TOCHER	DATE: APR 14. 2010
CHKD. BY: G. McLEAN	SCALE: NTS
APPR. BY: G. McLEAN	W.O. No: 12518
CUST. PO No:	

TITLE: JB-P0200
AC JUNCTION BOX

FOR: TESI UNIT #12518
HUSKY OIL OPERATIONS LTD.
CATERPILLAR G3516LE-AFRC
ARIEL RG357M

DWG. No: 12518-621 | SHEET No: 1 OF 2 | REV: 4

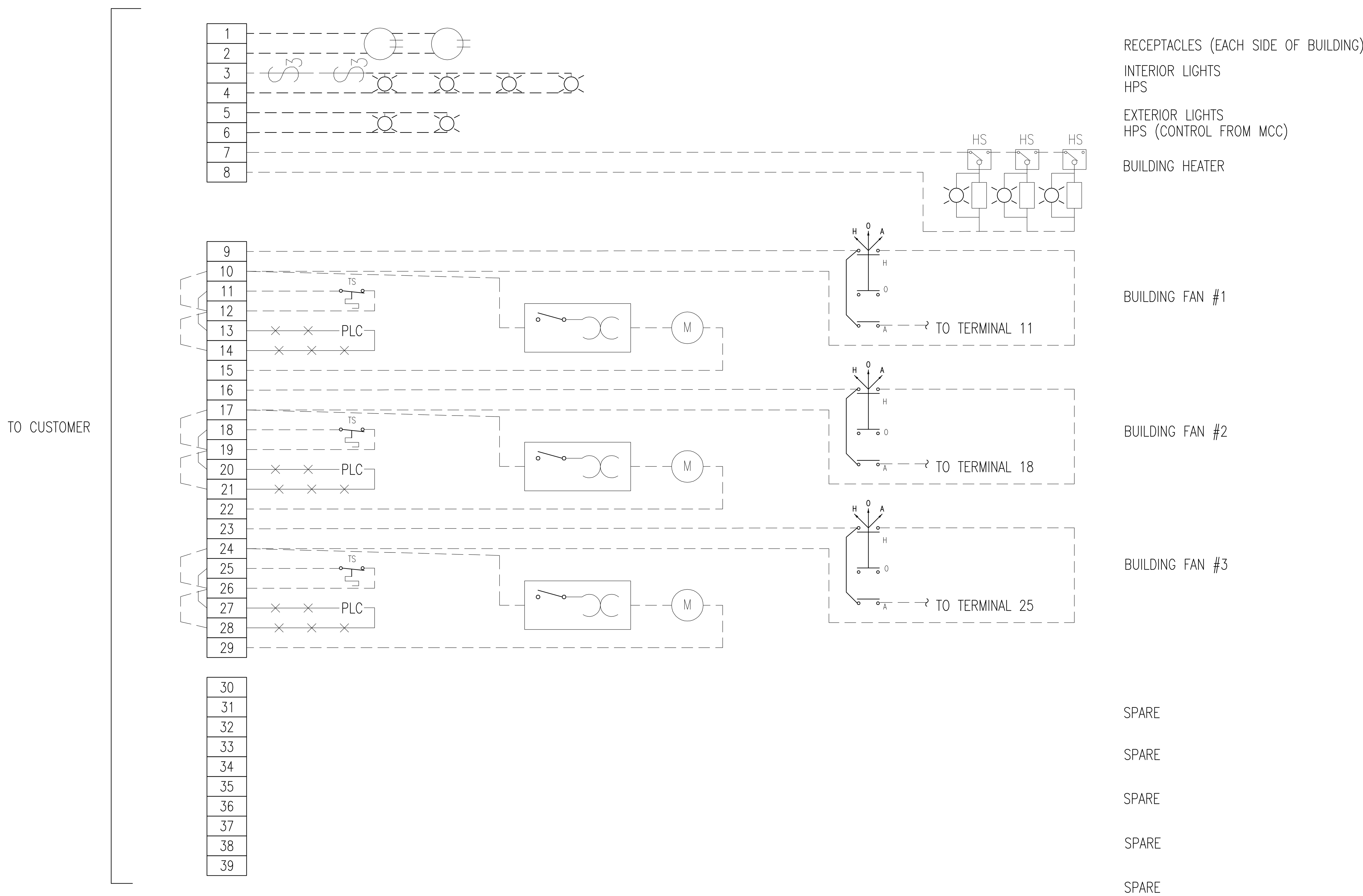
LEGEND

WIRING DESCRIPTION

- - - - SKID WIRING BY ENERFLEX LTD.

—×—×— WIRING BY OTHERS

120VAC RAIL



NOTE: TERMINALS ARE WEIDMULLER WDU6

PERMIT TO PRACTICE STAMP	ENGINEER STAMP

REV.	DESCRIPTION	DATE	BY	APPR.
4	AS BUILT	DEC 10/10	YK	TK
3	REVISION – WIRING CHANGE	OCT 25/10	YK	TO
2	REVISION – CONNECTION CHANGE PG 2	OCT 5/10	YK	CH
1	ISSUED FOR CONSTRUCTION	AUG 26/10	YK	GM

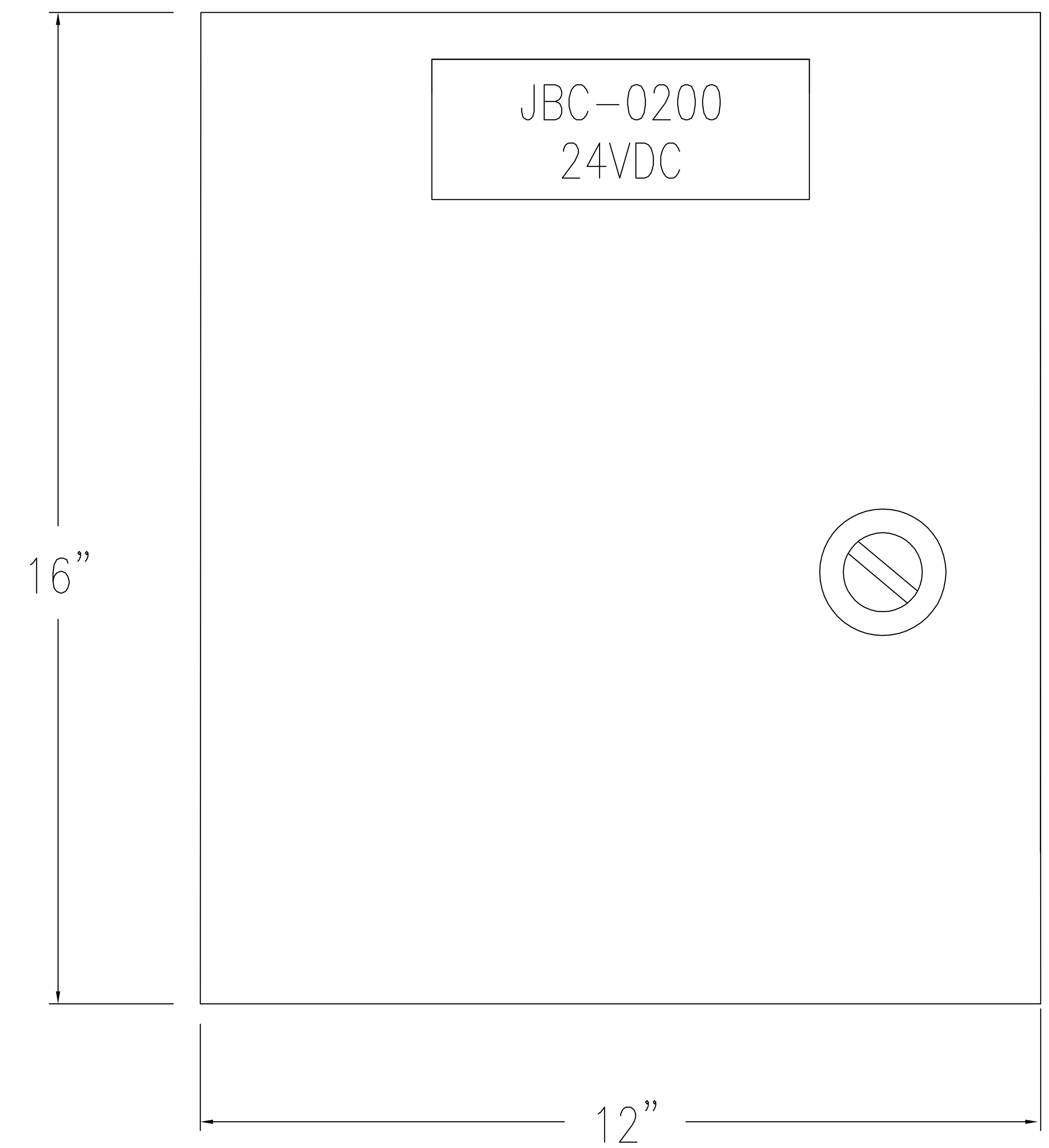
ENERFLEX

TITLE: JB–P0200 AC JUNCTION BOX

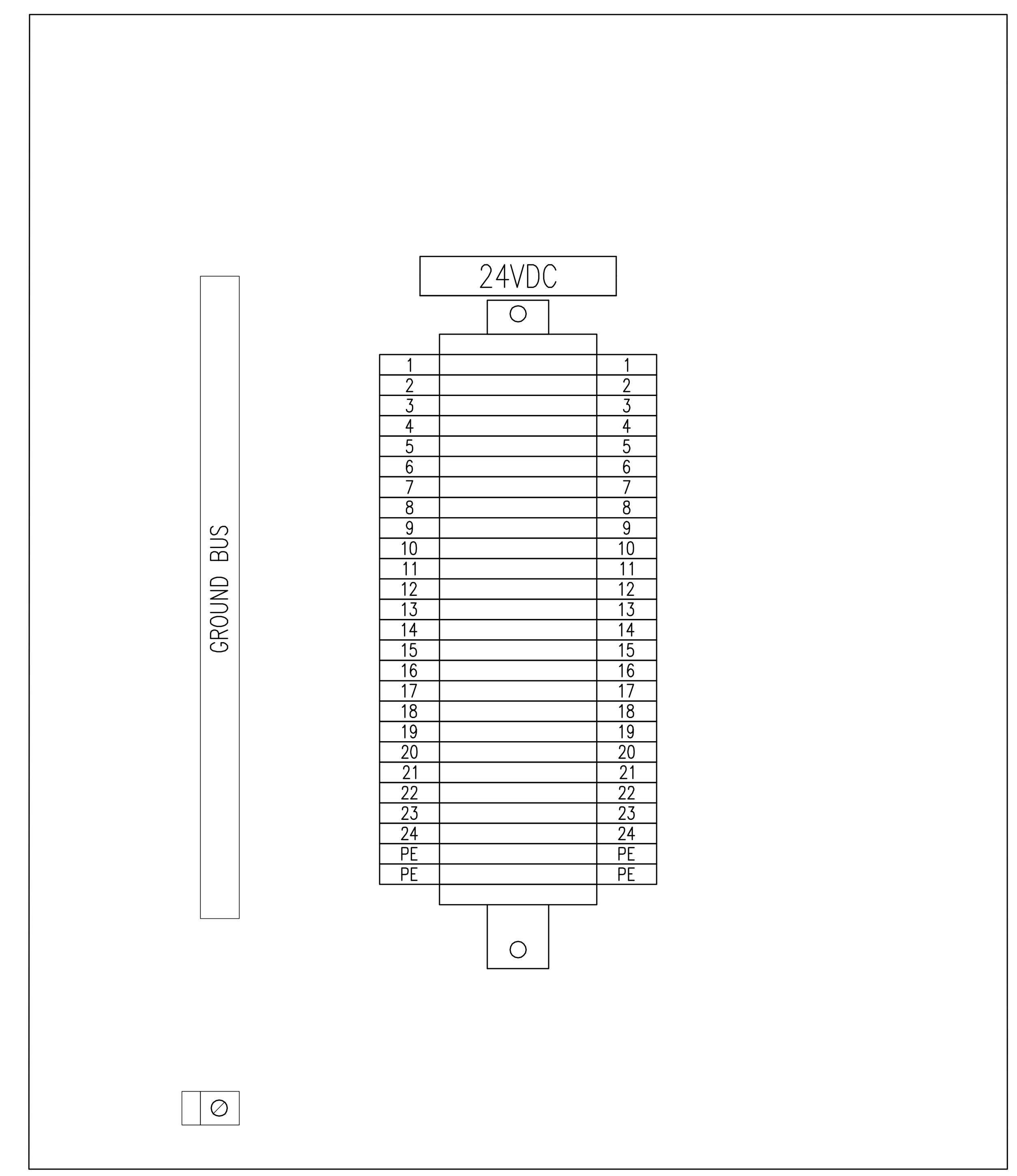
DRAWN BY: T.TOCHER	DATE: APR 14. 2010
CHKD. BY: G. McLEAN	SCALE: NTS
APPR. BY: G. McLEAN	W.O. No: 12518
CUST. PO No:	

FOR:
TESI UNIT #12518
HUSKY OIL OPERATIONS LTD.
CATERPILLAR G3516LE–AFRC
ARIEL RG357M

DWG. No: 12518–621 | SHEET No: 2 OF 2 | REV: 4



DOOR LAYOUT



BACK PANEL LAYOUT

NEMA4 ENCLOSURE 16 X 12 X 6"
HOFFMAN A14128CHQRFG

NOTE: ALL CABLE, CONDUCT CONNECTIONS
FROM BOTTOM OF THE JB

NOTE: INCLUDES BREATHER/DRAIN
CROUSE HINDS ECD18

NOTE: MOUNT JB SO BOTTOM
IS 18" ABOVE SKID FLOOR

REV.	DESCRIPTION	DATE	BY	APPR.
2	AS BUILT	DEC 10/10	YK	TK
1	ISSUED FOR CONSTRUCTION	AUG 26/10	YK	GM

PERMIT TO PRACTICE STAMP

ENGINEER STAMP

ENERFLEX

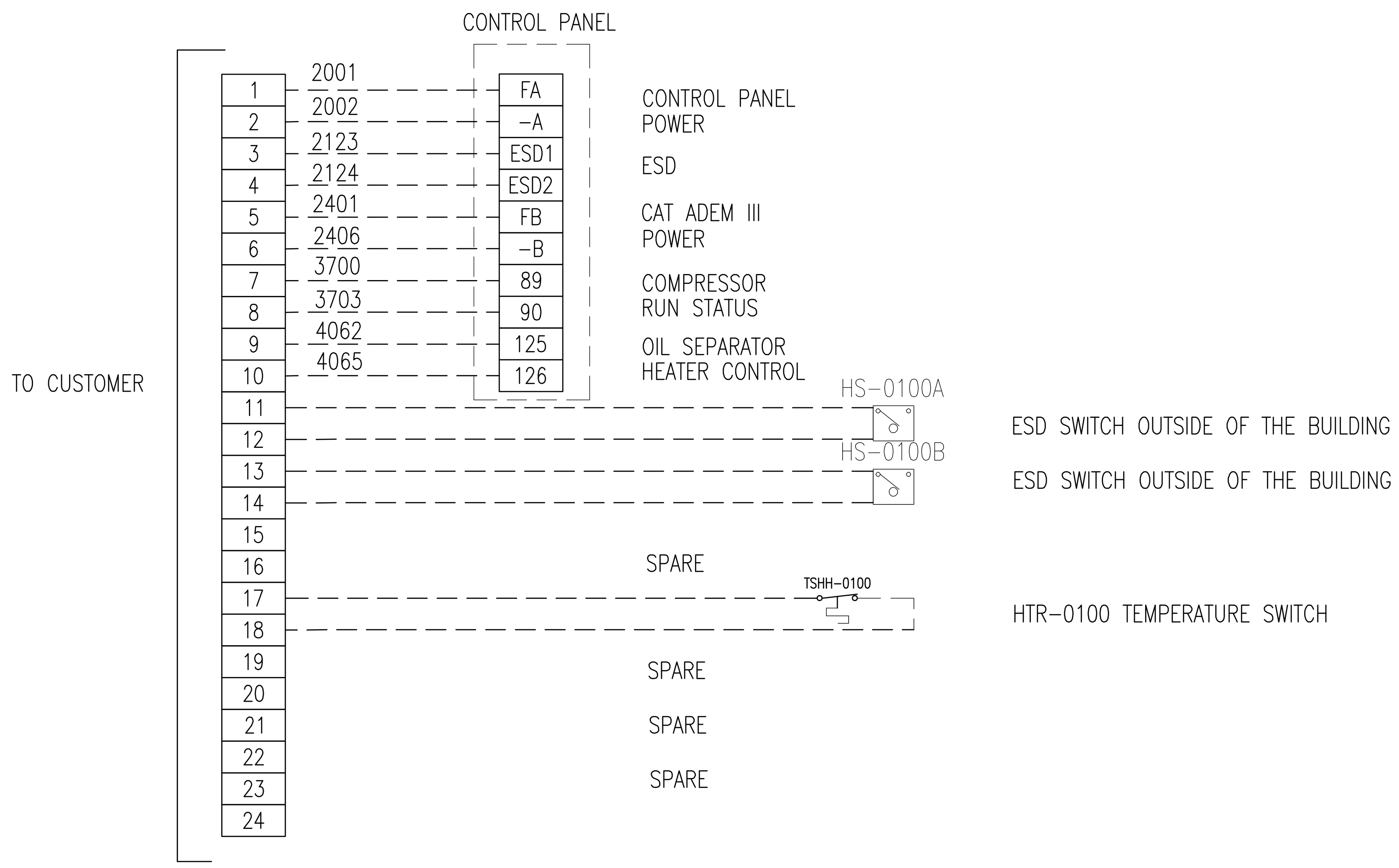
DRAWN BY: T.TOCHER	DATE: APR 14. 2010
CHKD. BY: G. McLEAN	SCALE: NTS
APPR. BY: G. McLEAN	W.O. No: 12518
CUST. PO No:	

TITLE: JB-C0200
24VDC JUNCTION BOX

FOR: TESI UNIT #12518
HUSKY OIL OPERATIONS LTD.
CATERPILLAR G3516LE-AFRC
ARIEL RG357M

DWG. No:	SHEET No:	REV:
12518-622	1 OF 2	2

24VDC RAIL



LEGEND

WIRING DESCRIPTION

- – – – SKID WIRING BY ENERFLEX LTD.
- –X–X– WIRING BY OTHERS

NOTE: TERMINALS ARE WEIDMULLER WDU6

PERMIT TO PRACTICE STAMP	ENGINEER STAMP

REV.	DESCRIPTION	DATE	BY	APPR.
2	AS BUILT	DEC 10/10	YK	TK
1	ISSUED FOR CONSTRUCTION	AUG 26/10	YK	GM

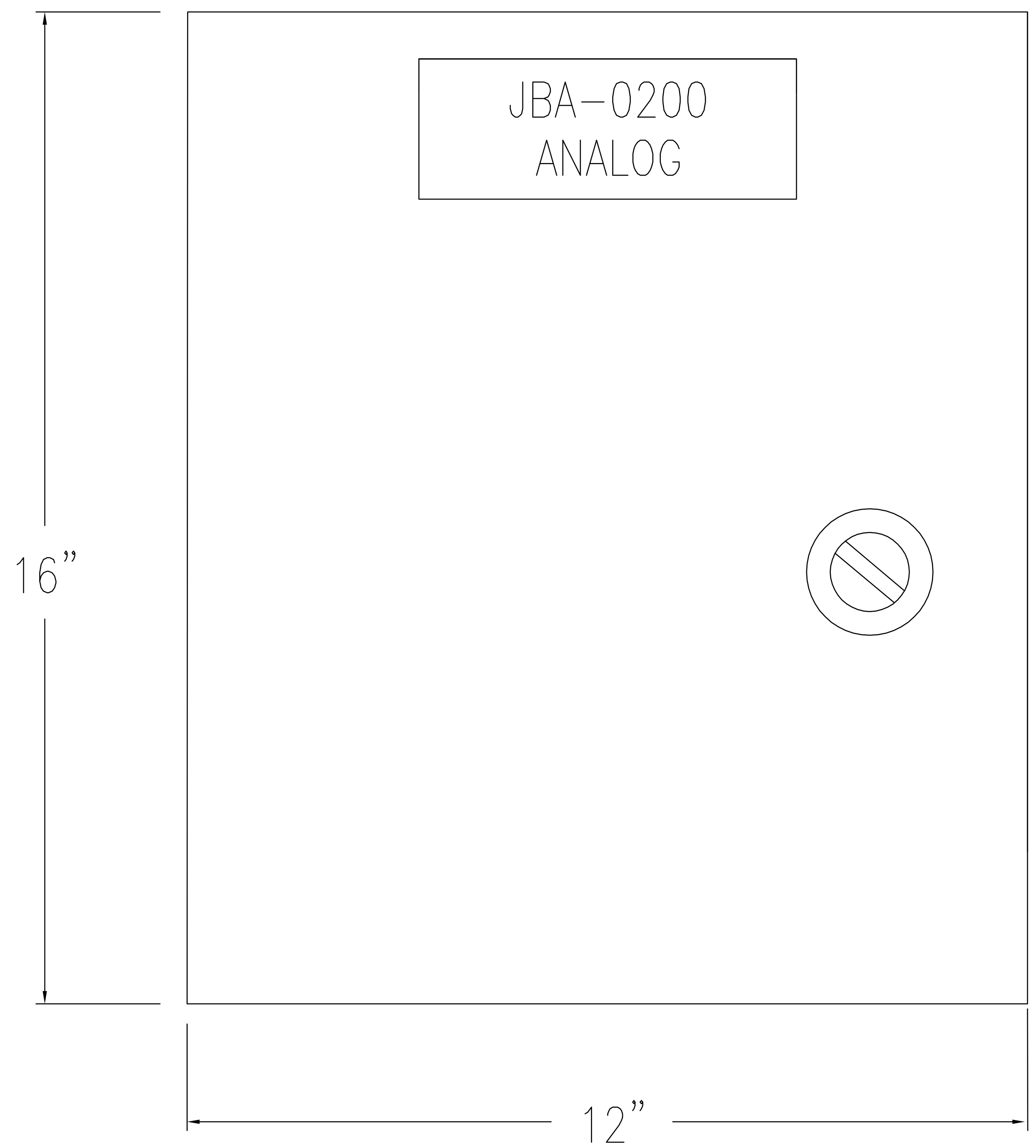
ENERFLEX

DRAWN BY: T.TOCHER	DATE: APR 14. 2010
CHKD. BY: G. McLEAN	SCALE: NTS
APPR. BY: G. McLEAN	W.O. No: 12518
CUST. PO No:	

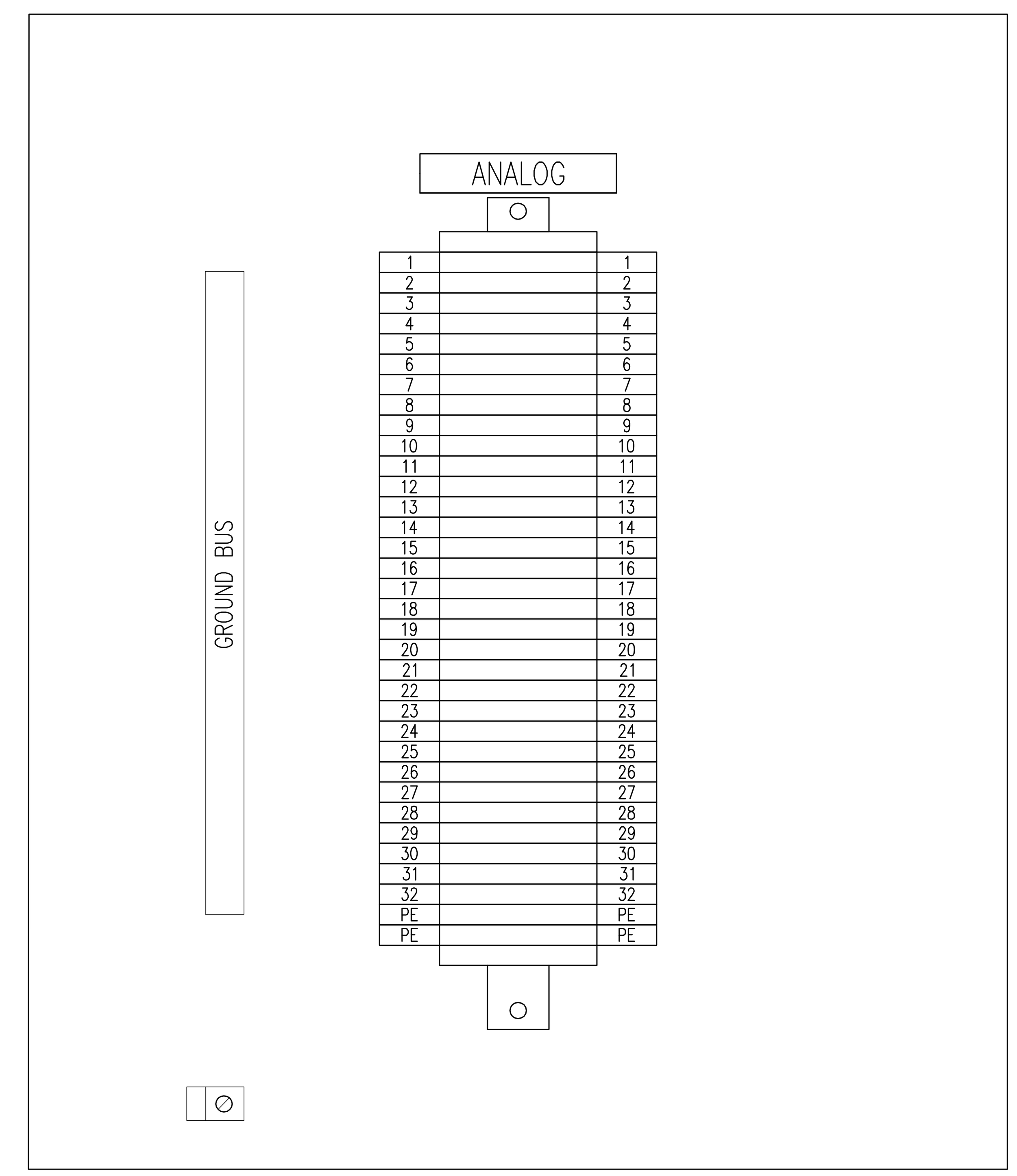
TITLE: JB-C0200
24VDC JUNCTION BOX

FOR: TESI UNIT #12518
HUSKY OIL OPERATIONS LTD.
CATERPILLAR G3516LE-AFRC
ARIEL RG357M

DWG. No: 12518-622 | SHEET No: 2 OF 2 | REV: 2



DOOR LAYOUT



BACK PANEL LAYOUT

NEMA4 ENCLOSURE 16 X 12 X 6"
HOFFMAN A14128CHQRFG

NOTE: ALL CABLE, CONDUCT CONNECTIONS
FROM BOTTOM OF THE JB

NOTE: INCLUDES BREATHER/DRAIN
CROUSE HINDS ECD18

NOTE: MOUNT JB SO BOTTOM
IS 18" ABOVE SKID FLOOR

REV.	DESCRIPTION	DATE	BY	APPR.
2	AS BUILT	DEC 10/10	YK	TK
1	ISSUED FOR CONSTRUCTION	AUG 26/10	YK	GM

PERMIT TO PRACTICE STAMP

ENGINEER STAMP

ENERFLEX

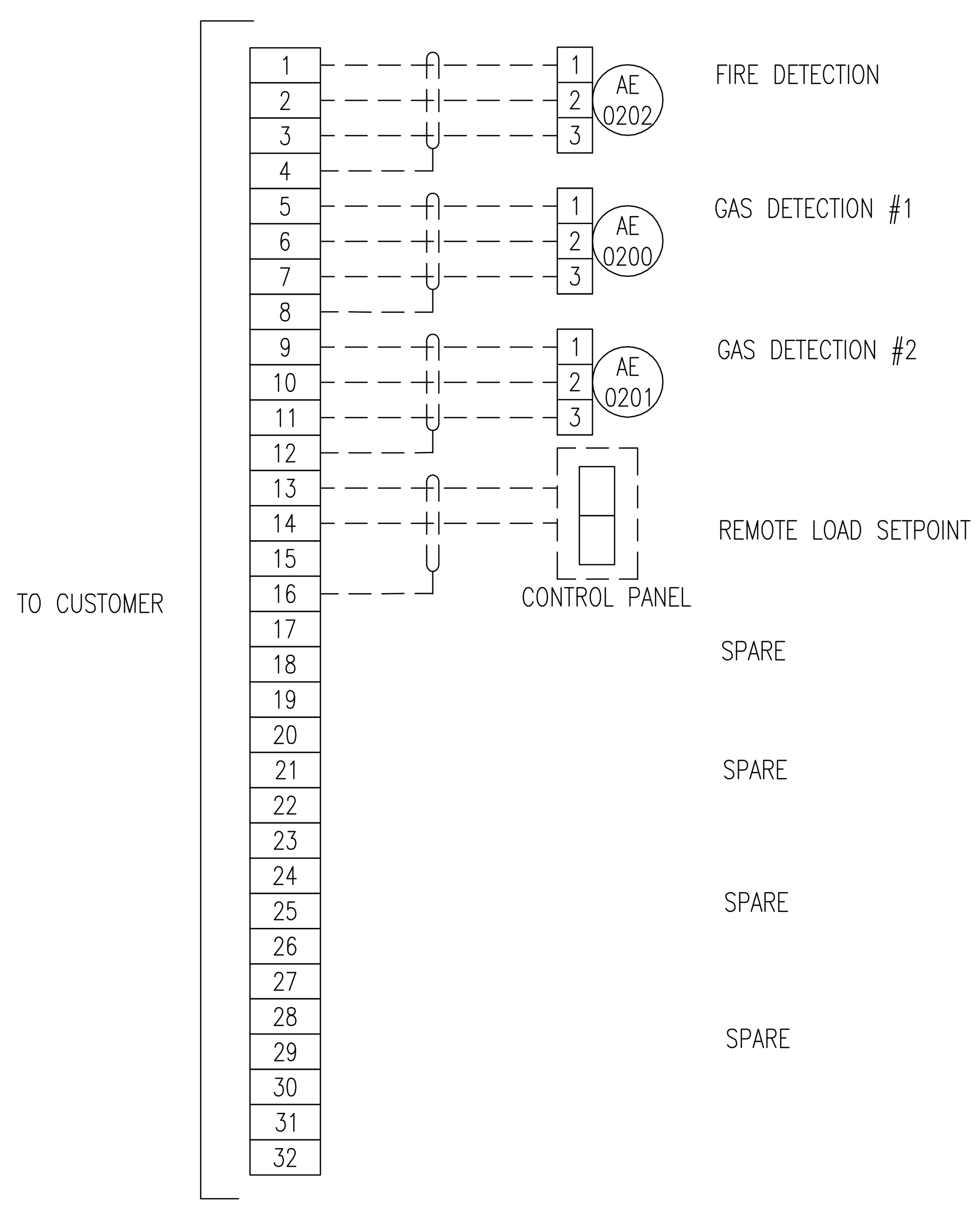
DRAWN BY: T.TOCHER	DATE: APR 14. 2010
CHKD. BY: G. McLEAN	SCALE: NTS
APPR. BY: G. McLEAN	W.O. No: 12518
CUST. PO No:	

TITLE: JB-A0200
ANALOG JUNCTION BOX

FOR: TESI UNIT #12518
HUSKY OIL OPERATIONS LTD.
CATERPILLAR G3516LE-AFRC
ARIEL RG357M

DWG. No: 12518-623 | SHEET No: 1 OF 2 | REV: 2

ANALOG RAIL



LEGEND

WIRING DESCRIPTION

- – – – SKID WIRING BY ENERFLEX LTD.
- —x—x— WIRING BY OTHERS

NOTE: INSTALL GAS DETECTION DISPALY OUTSIDE BUILDING. TUBE CALIBRATION PORTS TO CONVENIENT LEVEL.

NOTE: TERMINALS ARE WEIDMULLER WDU6

PERMIT TO PRACTICE STAMP

ENGINEER STAMP

REV.	DESCRIPTION	DATE	BY	APPR.
2	AS BUILT	DEC 10/10	YK	TK
1	ISSUED FOR CONSTRUCTION	AUG 26/10	YK	GM

ENERFLEX

TITLE: JB–A0200 ANALOG JUNCTION BOX

DRAWN BY: T.TOCHER	DATE: APR 14. 2010
CHKD. BY: G. McLEAN	SCALE: NTS
APPR. BY: G. McLEAN	W.O. No: 12518
CUST. PO No:	

FOR: TESI UNIT #12518 HUSKY OIL OPERATIONS LTD. CATERPILLAR G3516LE–AFRC ARIEL RG357M

DWG. No: 12518–623 SHEET No: 2 OF 2 REV: 2