Rockwell Automation
Allen-Bradley

1785 PLC-5 Programmable Controllers Quick Reference

Using this Manual

This Quick Reference provides information frequently needed for using and maintaining your Allen-Bradley PLC-5 processor.
It is intended for reference purposes only, and not as the sole source of information.

For more specific information on any topic in this Quick Reference, see:

- Enhanced and Ethernet PLC-5 Family Programmable Controllers User Manual, publication 1785-6.5.12
- Classic PLC-5 User Manual, publication 1785-6.2.1
- ControlNet PLC-5 Programmable Controllers Phase 1.5 User Manual, publication 1785-6.5.22

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

The Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control, publication SGI-1.1 (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices which should be taken into consideration when applying products such as those described in this publication.

Summary of Changes

In this release of the PLC-5 Quick Reference, we have altered the way we reference software documentation. Rather than show specific screens and key sequences which may vary according to the software package you are using, we refer you instead to the programming software documentation that accompanies your particular software package. Of course, we still provide the essential reference information you need to quickly accomplish your tasks, but if you have specific questions about software procedures, you should refer to your programming software documentation set.

To help you find new information, we included change bars as shown to the left of this paragraph.

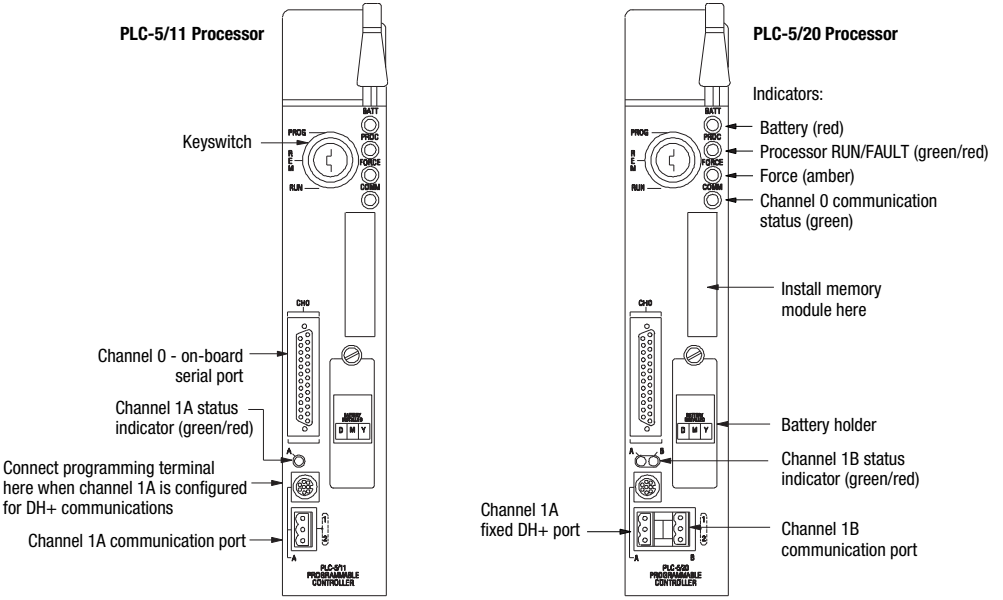
Conventions

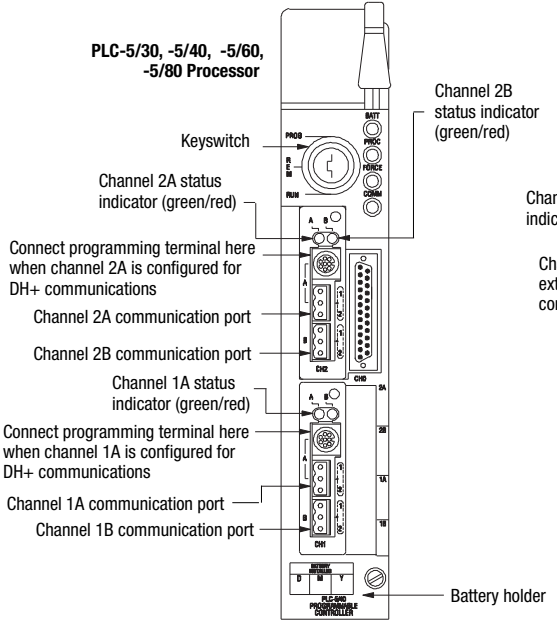
The table below describes the naming conventions used in this manual:

This name:	Represents these processors:
Enhanced	PLC-5/11™PLC-5/40™ PLC-5/20™PLC-5/60™ PLC-5/30™PLC5/80™ PLC-5/40L™PLC-5/60L™
Ethernet	PLC-5/20E™PLC-5/40E™ PLC5/80E™
ControlNet Phase 1.5	PLC-5/20C15™ 5/40C15™ 5/80C15™
Classic	PLC-5/10™PLC-5/15™ PLC-5/12™PLC-5/25™

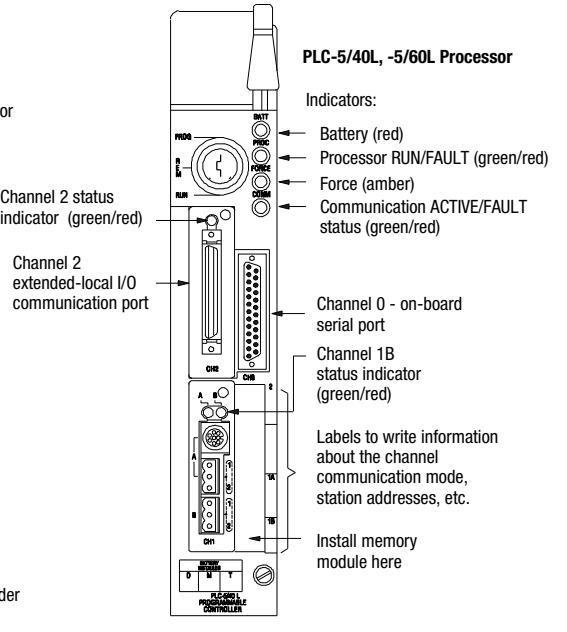
☞ You see this symbol in the lower right-hand corner of the page when information is continued on the next page.

Front Panel – Enhanced PLC-5 Processors



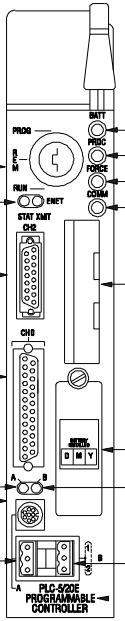


The PLC-5/30 processor has 2 communication ports and 1 serial port



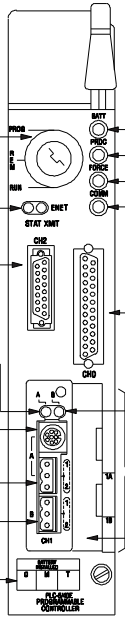
Front Panel – Ethernet
PLC-5 Processors

PLC-5/20E Processor



Indicators:
Battery (red)
Processor RUN/FAULT (green/red)
Force (amber)
Channel 0 communication status (green)
Keyswitch
Channel 2 Ethernet status indicators
Channel 2
Install memory module here
Channel 0 - on-board serial port
Channel 1A status indicator (green/red)
Battery holder
Channel 1B status indicator (green/red)
Connect programming terminal here
Channel 1A
Channel 1B

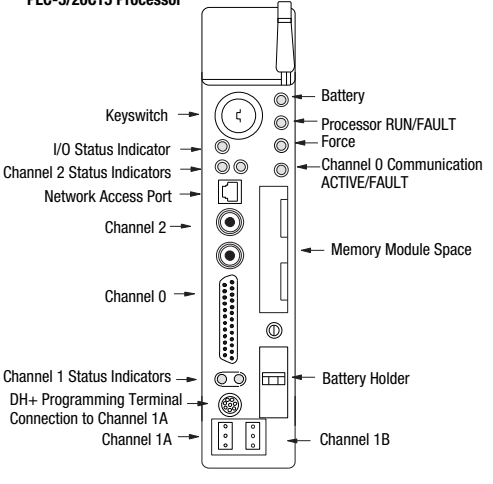
PLC-5/40E, -5/80E Processor



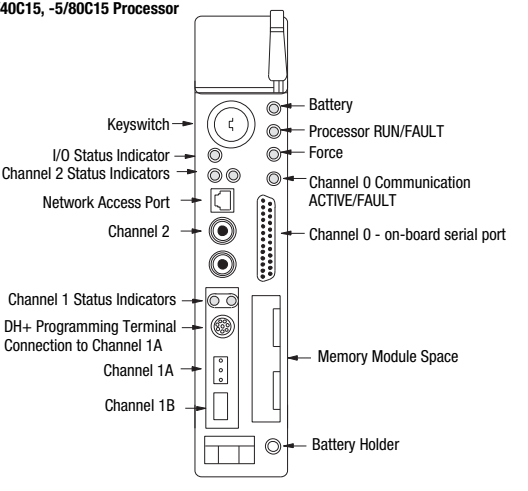
Indicators:
Battery (red)
Force (amber)
Processor RUN/FAULT (green/red)
Communication ACTIVE/FAULT (green/red)
Keyswitch
Channel 2 Ethernet status indicators
Channel 2
Channel 0 - on-board serial port
Channel 1A status indicator (green/red)
Channel 1B status indicator (green/red)
Connect programming terminal here
Labels to write information about the channel communication mode, station addresses, etc.
Channel 1A
Channel 1B
Install memory module here
Battery holder

Front Panel – ControlNet PLC-5 Processors

PLC-5/20C15 Processor



PLC-5/40C15, -5/80C15 Processor

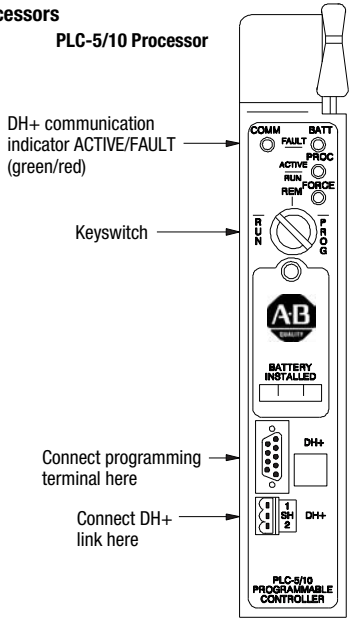


ControlNet PLC-5 Processors

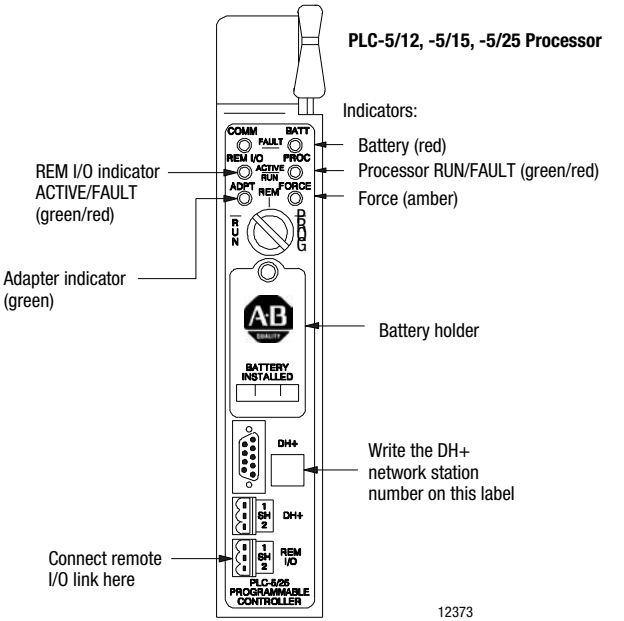
Phase	Catalog Number
1.0/1.25	1785L20C, -L40C, -L80C
1.5	1785L20C15, -L40C15, -L80C15

Front Panel – Classic PLC-5 Processors

PLC-5/10 Processor



PLC-5/12, -5/15, -5/25 Processor



12373

Comparison Chart for PLC-5 Family Processors

Processor	Memory (Words)	Local Chassis	Remote Chassis (I/O Racks)	I/O Capacity	Communication
PLC-5/10	6K	1 resident	none	128 (8-pt) [1], 256 (16-pt) [1], 512 (32-pt) [1]	DH+ link
PLC-5/12	6K	1 resident	none	128 (8-pt) [1], 256 (16-pt) [1], 512 (32-pt) [1]	adapter, DH+ link
PLC-5/15	6K (expands to 14K)	1 resident	12 (3 I/O racks)	• 512 [1] • 512 inputs and 512 outputs using 16- or 32-pt modules [2]	adapter/remote I/O scanner, DH+ link
PLC-5/25	13K (expands to 21K)	1 resident	28 (7 I/O racks)	• 1024 [1] • 1024 inputs and 1024 outputs using 16- or 32-pt modules [2]	adapter/remote I/O scanner, DH+ link
PLC-5/11	8K	1 resident	4 (1 I/O rack) rack must be addressed as rack 3	• 256 (8-pt), 384 (16-pt), or 512 (16-pt) [1] • 512(16-pt) or 768 (32-pt) [2]	• 1 channel (remote I/O scanner, adapter, DH+ link) • 1 RS-232, RS-422, RS-423 serial port

1 Any mix of I/O
2 Maximum I/O possible using 16-pt modules with 2-slot addressing or 32-pt modules with 1-slot addressing. Modules must alternate input/output in the chassis slots.

PLC-5 comparison chart continued...

Processor	Memory (Words)	Local Chassis	Remote Chassis (I/O Racks)	I/O Capacity	Communication
PLC-5/20	16K	1 resident	12 (3 I/O racks)	• 512 [1] • 512 inputs and 512 outputs using 16- or 32-pt modules	• 1 channel (remote I/O scanner, adapter, DH+ link) • 1 channel DH+ link • 1 RS-232, RS-422, RS-423 serial port
PLC-5/20E	16K	1 resident	12 (3 I/O racks)	• 512 [1] • 512 inputs and 512 outputs using 16- or 32-pt modules	• 1 channel (remote I/O scanner, adapter, DH+ link) • 1 channel DH+ link • 1 RS-232, RS-422, RS-423 serial port • 1 channel Ethernet
PLC-5/20C15	16K	1 resident	12 (3 I/O racks)	• 512 [1] • 512 inputs and 512 outputs using 16- or 32-pt modules	• 1 channel (remote I/O scanner, adapter, DH+ link) • 1 channel DH+ link • 1 RS-232, RS-422, RS-423 serial port • ControlNet
PLC-5/30	32K	1 resident	28 (7 I/O racks)	• 1024 [1] • 1024 inputs and 1024 outputs using16- or 32-pt modules	• 2 channels (remote I/O scanner, adapter, DH+ link) • 1 RS-232, RS-422, RS-423 serial port

[1] Any mix of I/O

PLC-5 comparison chart continued...

Processor	Memory (Words)	Local Chassis	Remote Chassis (I/O Racks)	I/O Capacity	Communication
PLC-5/40	48K[3]	1 resident	60 [2] (15 I/O racks)	• 2048 [1] • 2048 inputs and 2048 outputs using 16- or 32-pt modules	• 4 channels (remote I/O scanner, adapter, DH+ link) • 1 RS-232, RS-422, RS-423 serial port
PLC-5/40L	48K[3]	1 resident up to 16 extended	60 [2] (15 I/O racks)	• 2048 [1] • 2048 inputs and 2048 outputs using 16- or 32-pt modules	• 2 channels (remote I/O scanner, adapter, DH+ link) • 1 RS-232, RS-422, RS-423 serial port • 1 channel extended local I/O scanner
PLC-5/40E	48K[3]	1 resident (16 rack addressing capability)	60 (15 I/O racks)	• 2048 [1] • 2048 inputs and 2048 outputs using 16- or 32-pt modules	• 2 channels (remote I/O scanner, adapter, DH+ link) • 1 RS-232, RS-422, RS-423 serial port • 1 channel Ethernet
PLC-5/40C15	48K[3]	1 resident	60 15 I/O racks	• 2048 [1] • 2048 inputs and 2048 outputs using 16- or 32-pt modules	• 2 channels (remote I/O scanner, adapter, DH+ link) • 1 RS-232, RS-422, RS-423 serial port • 1 channel ControlNet
PLC-5/60 [3]	64K	1 resident	92 [2] (23 I/O racks)	• 3072 [1] • 3072 inputs and 3072 outputs using 16- or 32-pt modules	• 4 channels (remote I/O scanner, adapter, DH+ link) • 1 RS-232, RS-422, RS-423 serial port

1 Any mix of I/O
2 Maximum of 32 physical devices/channel
3 Maximum of 57K words per program file and 32K words per data table file

PLC-5 comparison chart continued...

Processor	Memory (Words)	Local Chassis	Remote Chassis (I/O Racks)	I/O Capacity	Communication
PLC-5/60L [3]	64K	1 resident up to 16 extended	64 [2] (23 I/O racks)	• 3072 [1] • 3072 inputs and 3072 outputs using16- or 32-pt modules	• 2 channels (remote I/O scanner, adapter, DH+ link) • 1 RS-232, RS-422, RS-423 serial port • 1 channel extended local I/O scanner
PLC-5/80 [3,4]	100K	1 resident	92 [2] (23 I/O racks)	• 3072 [1] • 3072 inputs and 3072 outputs using 16- or 32-pt modules	• 4 channels (remote I/O scanner, adapter, DH+ link) • 1 RS-232, RS-422, RS-423 serial port
PLC-5/80E [3,4]	100K	1 resident	92 [2] (23 I/O racks)	• 3072 [1] • 3072 inputs and 3072 outputs using 16- or 32-pt modules	• 2 channels (remote I/O scanner, adapter, DH+ link) • 1 RS-232, RS-422, RS-423 serial port • 1 channel Ethernet
PLC-5/80C15 [3.4]	100K	1 resident	92 [2] (23 I/O racks)	• 3072 [1] • 3072 inputs and 3072 outputs using 16- or 32-pt modules	• 2 channels (remote I/O scanner, adapter, DH+ link) • 1 RS-232, RS-422, RS-423 serial port • 1 channel ControlNet

[1] Any mix of I/O
[2] Maximum of 32 physical devices/channel
[3] Maximum of 57K words per program file and 32K words per data table file
[4] Maximum of 64K words total data table space

PLC-5 ControlNet Processors - Maximum I/O Map Entries

Phase 1.0/1.25						**Phase 1.5**					
Processor	Number of Mappings:	Number of DIF Files:	Number of DIF Words:	Number of DOF Files:	Number of DOF Words:	Processor	Number of Mappings:	Number of DIF Files:	Number of DIF Words:	Number of DOF Files:	Number of DOF Words:
PLC-5/20C	64	1	1000	1	1000	PLC-5/20C	64	2	2000	2	2000
PLC-5/40C	64	1	1000	1	1000	PLC-5/40C	96	3	3000	3	3000
PLC-5/80C	64	1	1000	1	1000	PLC-5/80C	128	4	4000	4	4000

1771 I/O Chassis for PLC-5 Family Processors

Catalog Number	Chassis Size	Mounting Backpanel	Mounting 19" Rack	Power Supply Socket
1771-A1B	4-slot	X		left
1771-A2B	8-slot	X		left
1771-A3B	12-slot	X	X	top
1771-A3B1	12-slot	X		left
1771-A4B	16-slot	X		left

The PLC-5 processors are also compatible with 1771-A1, A2, and A4 chassis with slot power supplies only.

When using these processors with the 1771-A1, A2, and A4 chassis:	Only this mode of addressing is supported:
Classic PLC-5 processors	2-slot and 1-slot in the local rack
Enhanced and Ethernet PLC-5 processors	2-slot addressing
ControlNet PLC-5 processors	2-slot addressing

Power Supply Modules in a Chassis
(containing a PLC-5 processor)

Power Supply	Input Power	Output Current (in Amps)	Output Current (in amps) when Parallel with:							Power Supply Location
			P3	P4	P4S	P4S1	P5	P6S	P6S1	
1771-P3	120V ac	3	6	11	11					slot
1771-P4	120V ac	8	11	16	16					slot
1771-P4S	120V ac	8	11	16	16					slot
1771-P4S1	100V ac	8				16				slot
1771-P4R	120V ac	8, 16, 24 [2]								slot
1771-P5	24V dc	8					16			slot
1771-P6S	220V ac	8						16		slot
1771-P6S1	200V ac	8							16	slot
1771-P6R	220V ac	8, 16, 24 [2]								slot
1771-P7	120/220V ac	16								external [1]
1771-PS7	120/220V ac	16								external [1]

[1] You cannot use an external power supply and a power supply module to power the same chassis; they are not compatible.
[2] See publication 1771-2.166 for more information.

Power Supplies in a Remote Chassis (1771-ASB) or an Extended Local I/O Chassis (1771-ALX)

Power Supply	Input Power	Output Current (in Amps)	Output Current (in amps) when Parallel with:							Power Supply Location
			P3	P4	P4S	P4S1	P5	P6S	P6S1	
1771-P3	120V ac	3	6	11	11					slot
1771-P4	120V ac	8	11	16	16					slot
1771-P4S	120V ac	8	11	16	16					slot
1771-P4S1	100V ac	8				16				slot
1771-P4R	120V ac	8, 16, 24 [2]								slot
1771-P5	24V dc	8					16			slot
1771-P6S	220V ac	8						16		slot
1771-P6S1	200V ac	8							16	slot
1771-P6R	220V ac	8, 16, 24 [2]								slot
1771-P1	120/220V ac	6.5								external [1]
1771-P2	120/220V ac	6.5								external [1]
1771-P7	120/220V ac	16								external [1]
1771-PS7	120/220V ac	16								external [1]
1777-P2	120/220V ac	9								external [1]
1777-P4	24V dc	9								external [1]

[1] You cannot use an external power supply and a power supply module to power the same chassis; they are not compatible.
[2] See publication 1771-2.166 for more information.

Front Panel Keyswitch

Operation	Keyswitch Position			
	RUN	PROG	REM	
			RUN	PROG
Execute programs (with outputs enabled)	X		X	
Execute programs (with outputs disabled)				
Save program to disk	X	X	X	X
Restore programs		X	X	X
Create or delete: ladder files, SFC files, data table files		X		X
Edit online: ladder files and SFC files (program files already exist)		X	X	X
Force live outputs	X		X	
Prohibit processor from scanning program		X		X
Change operating mode using a programming device			X	X
Download to/from EEPROM		X		X
Automatically configure remote I/O		X		X
Edit data table values (data table files already exist)	X	X	X	X
Establish ControlNet connections and exchange data	X	X	X	X

Processor Status File

This word of the status file:	Stores:
S:0	Arithmetic flags • bit 0 = carry • bit 1 = overflow • bit 2 = zero • bit 3 = sign
S:1	Processor status and flags Bit — Description 0 — RAM checksum is invalid at power-up 1 — processor in RUN mode 2 — processor in TEST mode 3 — processor in PROG mode 4 — processor burning EEPROM 5 — processor in download mode 6 — processor has test edits enabled 7 — mode select switch in REMOTE position 8 — forces enabled 9 — forces present 10 — processor successfully burned EEPROM 11 — performing online programming 12 — not defined 13 — user program checksum calculated 14 — last scan of ladder or SFC step 15 — processor running first program scan or the first scan of the next step in an SFC

This word of the status file:	Stores:
S:7	Global status bits: • S:7/0-7 - - rack fault bits for racks 0-7 • S:7/8-15 - - rack queue-full bits for racks 0-7 See also S:27, S:32, S:33, S:34, and S:35
S:8	Last program scan (in ms)
S:9	Maximum program scan (in ms)
S:2	Switch setting information • bits 0 - 6 DH+ station number • bit 11-12 are set based on the I/O chassis backplane switches • bit 12 bit 11 = I/O chassis addressing 0 0 illegal 1 0 1/2-slot 0 1 1-slot 1 1 2-slot • bit 13: 1 = load from EEPROM • bit 14: 1 = RAM backup not configured • bit 15: 1 = memory unprotected
S:3 to S:6	Active Node table for channel 1A Word Bits DH+ Station # 3 0-15 00-17 4 0-15 20-37 5 0-15 40-57 6 0-15 60-77

processor status file continued...

This word of the status file:	Stores:
S:10	Minor fault (word 1) Bit — Description 0 — battery is low (replace in 1-2 days) 1 — DH+ active node table has changed 2 — STI delay too short, interrupt program overlap 3 — EEPROM memory transfer at power-up 4 — edits prevent SFC continuing; data table size changed during program mode; reset automatically in run mode 5 — invalid I/O status file 6 — not defined 7 — no more command blocks exist 8 — not enough memory on the memory module to upload the program from the processor 9 — no MCP is configured to run 10 — MCP not allowed 11 — PII word number not in local rack 12 — PII overlap 13 — no command blocks exist to get PII 14 — arithmetic overflow 15 — SFC action overlap See also S:17

processor status file continued...

This word of the status file:	Stores:	
S:11	Major fault	
	Bit	Description
	0	corrupted program file (codes 10-19)
	1	corrupted address in ladder file (codes 20-29)
	2	programming error (codes 30-49)
	3	SFC fault (codes 71-79)
	4	error while assembling program (code 70); duplicate LBLs found
	5	start-up protection fault; processor sets this bit when powering up in run mode if bit S:26/1 is set
	6	peripheral device fault
	7	jumped to fault routine (codes 0-9)
	8	watchdog faulted
	9	system configured wrong (codes 80-89)
	10	recoverable hardware error
	11	MCP does not exist or is not ladder or SFC file
	12	PII does not exist or is not ladder
	13	STI does not exist or is not ladder
	14	fault routine does not exist or is not ladder
	15	fault occurred in a non-ladder file

processor status file continued...

This word of the status file:	Stores:	
S:12	Fault codes	
	Code	Description
	0-9	user-defined
	10	failed data table check
	11	bad user program checksum
	12	bad integer operand type
	13	bad mixed mode operand type
	14	not enough operands for instruction
	15	too many operands for instruction
	16	bad instruction found
	17	no expression end in a CPT math expression
	18	missing end of edit zone
	19	download aborted
	20	indirect address out of range (high)
	21	indirect address out of range (low)
	22	attempt to access undefined file
	23	file number less than 0 or greater than number of defined files; or, indirect reference to file 0, 1, 2; or bad file number24 indirect reference to wrong file type
	25	reserved
	26	reserved
	27	reserved
	28	reserved
	29	reserved
	30	subroutine jump nesting level exceeded

processor status file continued...

This word of the status file:	Stores:	
S:12 continued...	Fault codes	
	Code	Description
	31	too few subroutine parameters
	32	jump to non-ladder file
	33	CAR routine not 68000 code
	34	bad timer parameters entered
	35	bad PID delta time entered
	36	PID setpoint out of range
	37	invalid I/O specified in an immediate I/O instruction
	38	invalid use of return instruction
	39	FOR loop missing NXT
	40	control file too small
	41	NXT instruction with no FOR
	42	jump target does not exist or JMP missing LBL
	43	file is not an SFC
	44	error using SFR
	45	invalid channel number entered
	46	IDI or IDO instruction length operand too long (> 64 words)
	46-69	reserved

processor status file continued...

This word of the status file:	Stores:	
S:12 continued...	Fault codes	
	Code	Description
	70	duplicate labels
	71	SFC subchart is already executing
	72	tried to stop an SFC that is not running
	73	maximum number of SFC subcharts exceeded
	74	SFC file error
	75	SFC contains too many active steps
	76	SFC step loops back to itself
	77	SFC references a step, transition, subchart, or SC file that is missing, empty or too small
	78	SFC could not continue after power loss
	79	error in downloading an SFC to a processor that cannot run SFCs or this specific PLC processor does not support this Enhanced SFC
	80	I/O configuration error
	81	illegal setting of I/O chassis backplane switch
	82	illegal cartridge type
	83	user watchdog fault
	84	error in user-configured adapter mode block transfers
	85	bad cartridge
	86	cartridge incompatible with host
	87	rack addressing overlap (includes any adapter channel)

processor status file continued...

This word of the status file:	Stores:	
S:12 continued...	Fault codes	
	Code	Description
	88	scanner channels are overloading the remote I/O buffer; too much data for the processor to process
	90	Sidecar module extensive memory test failed
	91	Sidecar module undefined message type
	92	Sidecar module requesting undefined pool
	93	Sidecar module illegal maximum pool size
	94	Sidecar module illegal ASCII message
	95	Sidecar module reported fault, which may be the result of a bad program that corrupts memory or of a hardware failure
	96	Sidecar module not physically connected to the PLC-5 processor
	97	Sidecar module requested a pool size that is too small for PCCC command (occurs at power-up)
	98	Sidecar module first/last 16 bytes RAM test failed
	99	Sidecar module-to-processor data transfer faulted
	100	Processor-to-sidecar module data transfer failed
	101	Sidecar module end of scan data transfer failed
	102	The file number specified for raw data transfer through the sidecar module is an illegal value
	103	The element number specified for raw data transfer through the sidecar module is an illegal value
	104	The size of the raw data transfer requested through the sidecar module is an illegal size
	105	The offset into the raw data transfer segment of the sidecar module is an illegal value

processor status file continued...

This word of the status file:	Stores:
S:12 continued...	Fault codes Code — Description 106 — Sidecar module transfer protection violation; for PLC-5/26, -5/46, and -5/86 processors only 200 — ControlNet scheduled output data missed 201 — ControlNet input data missed 202 — Not used 203 — Reserved 204 — ControlNet configuration is too complex 205 — ControlNet configuration exceeds bandwidth 206 — Reserved 207 — Reserved 208 — Too many pending ControlNet I/O connections
S:13	Program file where fault occurred
S:14	Rung number where fault occurred
S:15	VME status file
S:16	I/O Status File

processor status file continued...

This word of the status file:	Stores:
S:17	Minor fault (word 2) Bit — Description 0 — BT queue full to remote I/O 1 — queue full – channel 1A; maximum remote block transfers used 2 — queue full – channel 1B; maximum remote block transfers used 3 — queue full – channel 2A; maximum remote block transfers used 4 — queue full – channel 2B; maximum remote block transfers used 5 — no modem on serial port 6 — remote I/O rack in local rack table; or, remote I/O rack is greater than the image size 7 — firmware revision for channel pairs 1A/1B or 2A/2B does not match processor firmware revision 8 — ASCII instruction error 9 — duplicate node address 10 — DF1 master poll list error 11 — protected processor data table element violation 12 — protected processor file violation 13 — using all 32 ControlNet MSGs 14 — using all 32 ControlNet 1771 READ and/or 1771 WRITE CIOs 15 — using all 8 ControlNet Flex I/O CIOs See also S:10.
S:18	Processor clock year
S:19	Processor clock month
S:20	Processor clock day
S:21	Processor clock hour
S:22	Processor clock minute
S:23	Processor clock second

processor status file continued...

This word of the status file:	Stores:
S:24	Indexed addressing offset
S:25	Reserved
S:26	User control bits Bit — Description 0 — Restart/continuous SFC: when reset, processor restarts at first step in SFC. When set, processor continues with active step after power loss or change to RUN 1 — Start-up protection after power loss: when reset, no protection. When set, processor sets major fault bit S:11/5 when powering up in run mode 2 — Define the address of the local rack: when reset, local rack address is 0. When set, local rack address is 1 3 — Set complementary I/O: when reset, complementary I/O is not enabled. When set, complementary I/O is enabled 4 — Local block transfer compatibility bit: when reset, normal operation. When set, eliminates frequent checksum errors to certain BT modules 5 — PLC-3 scanner compatibility bit: when set (1), adapter channel response delayed by 1 ms; when reset (0), operate in normal response time 6 — Data table-modification inhibit bit. When set (1), user cannot edit the data table while processor is in run mode
S:27	Rack control bits: • S:27/0-7 - - I/O rack inhibit bits for racks 0-7 • S:27/8-15 - - I/O rack reset bits for racks 0-7 See also S:7, S:32, S:33, S:34, and S:35.
S:28	Program watchdog setpoint

processor status file continued...

This word of the status file:	Stores:
S:29	Fault routine file
S:30	STI setpoint
S:31	STI file number
S:32	Global status bits: • S:32/0-7 - - rack fault bits for racks 10-17 (octal) • S:32/8-15 - - rack queue-full bits for racks 10-17 See also S:7, S:27, S:33, S:34, and S:35.
S:33	Rack control bits: • S:33/0-7 - - I/O rack inhibit bits for racks 10-17 (octal) • S:33/8-15 - - I/O rack reset bits for racks 10-17 See also S:7, S:27, S:32, S:34, and S:35.
S:34	Global status bits: • S:34/0-7 - - rack fault bits for racks 20-27 (octal) • S:34/8-15 - - rack queue-full bits for racks 20-27 See also S:7, S:27, S:32, S:33, and S:35.
S:35	Rack control bits: • S:35/0-7 - - I/O rack inhibit bits for racks 20-27 (octal) • S:35/8-15 - - I/O rack reset bits for racks 20-27 See also S:7, S:27, S:32, S:33, and S:34.
S:36	Reserved
S:37	Reserved

processor status file continued...

This word of the status file:	Stores:
Classic PLC-5 processors use only 37 words for the status file. Therefore, the following descriptions apply only to Enhanced, Ethernet, and ControlNet processors.	
S:38 - S:45	Reserved
S:46	PII program file number
S:47	PII module group
S:48	PII bit mask
S:49	PII compare value
S:50	PII down count
S:51	PII changed bit
S:52	PII events since last interrupt
S:53	STI scan time (in ms)
S:54	STI maximum scan time (in ms)
S:55	PII last scan time (in ms)
S:56	PII maximum scan time (in ms)
S:57	User program checksum
S:58	Reserved
S:59	Extended-local I/O channel discrete transfer scan (in ms)
S:48	PII bit mask

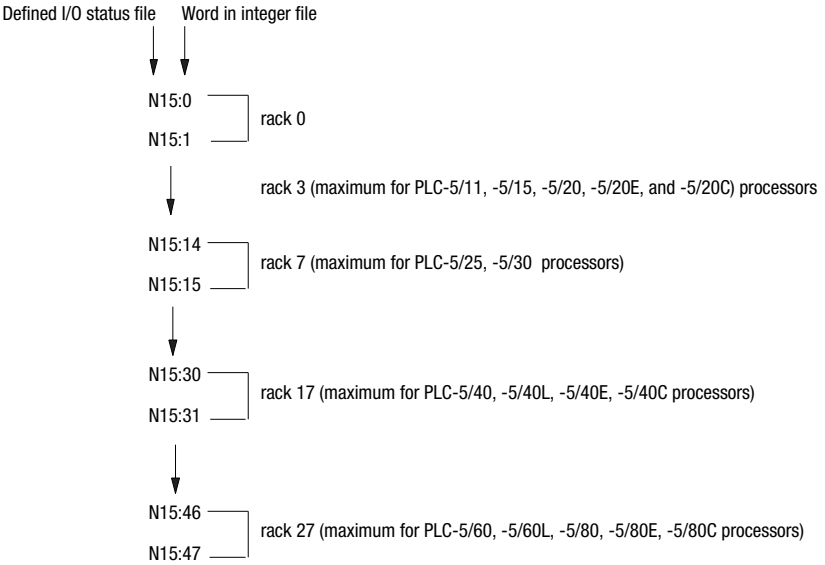
processor status file continued...

This word of the status file:	Stores:
S:60	Extended-local I/O channel discrete maximum scan (in ms)
S:61	Extended-local I/O channel block-transfer scan (in ms)
S:62	Extended-I/O channel maximum block-transfer scan (in ms)
S:63	Protected processor data table protection file number
S:64	The number of remote block transfer command blocks being used by channel pair 1A/1B.
S:65	The number of remote block transfer command blocks being used by channel 2A/2B or by channel 2 (ControlNet)
S:66	Reserved
S:72*	ControlNet node of this processor
S:73*	ControlNet PLC-2 compatibility file
S:74*	Time in msec between itemations of ControlNet subsystem diagnostics
S:75*	Maximum of S:74
S:76	Number of slots in processor-resident local chassis
S:77	Communication time slice for communication housekeeping functions (in ms)
S:78	MCP I/O update disable bits Bit 0 for MCP A Bit 1 for MCP B, etc.
* Applies only to ControlNet phase 1.5 PLC-5 processors.	

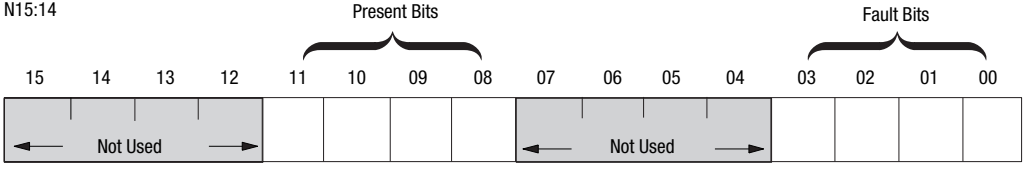
processor status file continued...

This word of the status file:	Stores:
S:79	MCP inhibit bits Bit 0 for MCP A Bit 1 for MCP B etc.
S:80-S:127	MCP file number MCP scan time (in ms) MCP max scan time (in ms) The above sequence applies to each MCP; therefore, each MCP has 3 status words. For example, word 80: file number for MCP A word 81: scan time for MCP A word 82: maximum scan time for MCP A word 83: file number for MCP B word 84: scan time for MCP B etc.

I/O Status File Format
(N:15 is defined in word S:16 of the processor status file.)

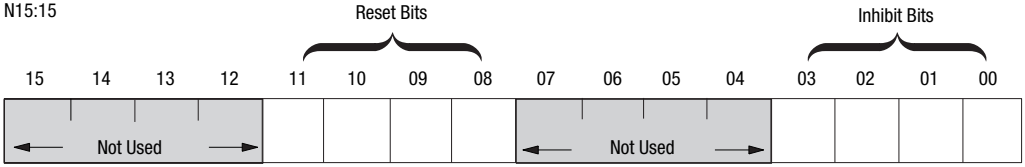


Word 1 in the I/O Status File



This bit:		Corresponds to:
Fault bits	00	first 1/4 rack starting I/O group 0
	01	second 1/4 rack starting I/O group 2
	02	third 1/4 rack starting I/O group 4
	03	fourth1/4 rack starting I/O group 6
Present bits	08	first 1/4 rack starting I/O group 0
	09	second 1/4 rack starting I/O group 2
	10	third 1/4 rack starting I/O group 4
	11	fourth1/4 rack starting I/O group 6

Word 2 in the I/O Status File



This bit:		Corresponds to:
Inhibit bits	00	first 1/4 rack starting I/O group 0
	01	second 1/4 rack starting I/O group 2
	02	third 1/4 rack starting I/O group 4
	03	fourth1/4 rack starting I/O group 6
Reset bits	08	first 1/4 rack starting I/O group 0
	09	second 1/4 rack starting I/O group 2
	10	third 1/4 rack starting I/O group 4
	11	fourth1/4 rack starting I/O group 6

ATTENTION: When you use a ladder program or the software to inhibit and reset an I/O rack, you must set or clear the reset and inhibit bits that correspond to each quarter rack in a given chassis. Failure to set all the appropriate bits could cause unpredictable operation due to scanning only part of the I/O chassis.

Addressing Data Table Files
(Enhanced, Ethernet, and ControlNet Processors) Series E and Later –

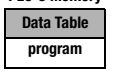
File Type	File-Type Identifier	File Number	Maximum Size of File 16-bit words and structures[c]				Memory Used in Overhead for each File (in 16-bit words)	Memory Used (in 16-bit words) per Word, Character, or Structure
			PLC-5/11, -5/20	PLC-5/30	PLC-5/40	PLC-5/60, -5/80		
Output image	O	0	32	64	128	192	6	1/word
Input image	I	1	32	64	128	192	6	1/word
Status	S	2	128	128	128	128	6	1/word
Bit (binary)	B	3[a]	2000 words				6	1/word
Timer	T	4[a]	6000 words/2000 structures				6	3/structure
Counter	C	5[a]	6000 words/2000 structures				6	3/structure
Control	R	6[a]	6000 words/2000 structures				6	3/structure
Integer	N	7[a]	2000 words				6	1/word
Floating-point	F	8[a]	4000 words/2000 structures				6	2/structure
ASCII	A	3-999	2000 words				6	1/2 per character
BCD	D	3-999	2000words				6	1/word
Block-transfer	BT	3-999	12000 words/2000 structures				6	6/structure
CIO	CT	3-999	12000 words/2000 structures				6	6/structure
Message	MG	3-999	32760 words/585 structures[b]				6	56/structure
PID	PD	3-999	32718 words/399 structures[b]				6	82/structure
SFC status	SC	3-999	6000 words/2000 structures				6	3/structure
ASCII string	ST	3-999	32760 words/780 structures[b]				6	42/structure
Unused	--	9-999	6				6	0

a. This is the default file number and type. For this file type, you can assign any file number from 3 through 999.
b. The maximum size of a data table file is 32K words. The maximum size of the entire data table is 64K words
c. ControlNet PLC-5s do not support 2000 elements/file. The maximum size of a data table file is 32K words. The maximum size of the entire data table is 64K words
d. ControlNet PLC-5s only.

File Type	File-Type Identifier	File Number	Maximum Size of File 16-bit words and structures				Memory Used in Overhead for each File (in 16-bit words)	Memory Used (in 16-bit words) per Word, Character, or Structure
			PLC-5/11, -5/20	PLC-5/30	PLC-5/40	PLC-5/60, -5/80		
Output image	O	0	32	64	128	192	6	1/word
Input image	I	1	32	64	128	192	6	1/word
Status	S	2	128	128	128	128	6	1/word
Bit (binary)	B	3[a]	1000 words				6	1/word
Timer	T	4[1]	3000 words/1000 structures				6	3/structure
Counter	C	5[1]	3000 words/1000 structures				6	3/structure
Control	R	6[1]	3000 words/1000 structures				6	3/structure
Integer	N	7[1]	1000 words				6	1/word
Floating-point	F	8[1]	2000 words/1000 structures				6	2/structure
ASCII	A	3-999	1000 words				6	1/2 per character
BCD	D	3-999	1000words				6	1/word
Block-transfer	BT	3-999	6000 words/1000 structures				6	6/structure
Message	MG	3-999	32760 words/585 structures[b]				6	56/structure
PID	PD	3-999	32718 words/399 structures[2]				6	82/structure
SFC status	SC	3-999	3000 words/1000 structures				6	3/structure
ASCII string	ST	3-999	32760 words/780 structures[2]				6	42/structure
Unused	--	9-999	6				6	0

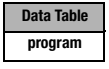
a. This is the default file number and type. For this file type, you can assign any file number from 3 through 999.
b. The maximum size of a data table file is 32K words. The maximum size of the entire data table is 64K words
c. ControlNet PLC-5s do not support 2000 elements/file.

Data Table Files - Classic Processors



File Description		Number (Default File)	Maximum Size of File (16-bit words and structures)		Memory Used
			PLC-5/10, -5/12, -5/15	PLC-5/25	
Output Image	O	0	32	64	2/file + 1/word
Input Image	I	1	32	64	2/file + 1/word
Status	S	2	32	32	2/file + 1/word
Bit (binary)	B	3-999 (3)	1000 words		2/file + 1/word
Timer	T	3-999 (4)	3000 words/1000 structures		2/file + 3/structure
Counter	C	3-999 (5)	3000 words/1000 structures		2/file + 3/structure
Control	R	3-999 (6)	3000 words/1000 structures		2/file + 3/structure
Integer	N	3-999 (7)	1000 words		2/file + 1/word
Floating Point	F	3-999 (8)	1000 words		2/file + 2/structure
ASCII	A	3 - 999	1000 words		2/file + 1/2 per character
BCD	D	3 - 999	1000 words		2/file + 1/word
Extra Storage		3 - 999			

Program Files



Description	Program File Number Classic PLC-5 Processors	Program File Number Enhanced, Ethernet, and ControlNet PLC-5 Processors
System	0	0
Sequential Function	1	1 - 1999 [2]
Ladder	2 - 999	2 - 1999 [2]
Structured Text[1]		2 - 1999 [2]
Assigned as needed: Subroutines Fault Routines Selectable Timed Interrupts Processor Input Interrupts [1] SFC Step/Transition SFC Actions [1]	3 - 999	2 - 1999

[1] Enhanced, Ethernet, and ControlNet PLC-5 processors only.

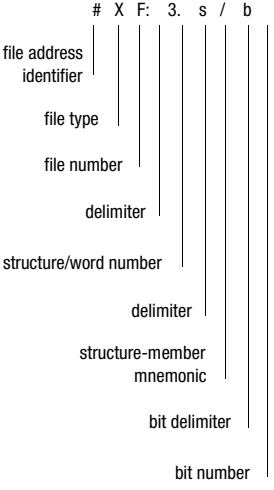
[2] Enhanced, Ethernet, and ControlNet PLC-5 processors can have up to 16 main control programs (in any combination of SFC, ladder, and structured text).

I/O Image Addressing

a:bbc/dd

a	I/O data type identifier I - input device O - output device	
bb	I/O rack number 00 - 03 (octal) 00 - 07 (octal) 00 - 17 (octal) 00 - 27 (octal)	 PLC-5/10, -5/11, -5/12, -5/15, -5/20, -5/20E, -5/20C15 PLC-5/25, -5/30 PLC-5/40, -5/40L, -5/40E, -5/40C15 PLC-5/60, -5/60L, -5/80, -5/80E, -5/80C15
c	I/O group number	0 - 7 (octal)
dd	terminal (bit) number	00 - 17 (octal)
Examples:	I:001/07 O:074/10	input device, rack 00, group 1, terminal (bit) 7 output device, rack 07, group 4, terminal (bit) 10

Logical Addressing



Where:	Is the:
#	File address identifier. Omit for bit, word, and structure addresses (also indicates indexed addressing, see next page)
X	File type: B - binary; C - counter; F - floating point; I - input; N - integer; O - output; R - control; S - status; T - timer; A - ASCII; D - BCD; BT - block transfer [1]; MG - message [1]; PD - PID [1]; SC - SFC status [1]; CT - ControlNet Transfer [2]; ST - ASCII string [1]
F	File number: 0 - output 1 - input 2 - status 3 - 999 any other type
:	Colon delimiter separates file and structure/word numbers
e	Structure/word number: 0 - 277 octal for input/output files 0 - 31 decimal for the status file (Classic PLC-5 processors) up to: 0 - 127 decimal for the status file 0 - 999 for all the file types except MG, PD, and ST files
.	Period delimiter is used only with structure-member mnemonics in counter, timer and control files
s	Structure-member mnemonic is used only with timer, counter, control, BT, MG, PD, SC, and ST files
/	Bit delimiter separates bit number
b	Bit number: 00 - 07 or 10 - 17 for input/output files 00 - 15 for all other files 00 - 15,999 for binary files when using direct bit address

[1] Enhanced, Ethernet, and ControlNet PLC-5 processors only.
[2] ControlNet only.

Indexed Addressing

Indexed addressing offsets an address by the number of elements you select. You store the offset value in an offset word in word 24 of the status file S:24. The processor starts operation at the base address plus the offset. You can manipulate the offset word in your ladder logic.

The indexed address symbol is the # character. Place the # character immediately before the file-type identifier in a logical address.

Important: File instructions manipulate the offset value stored at S:24. Make sure that you monitor or load the offset value you want prior to using an indexed address. Unpredictable machine operation could occur.

Indirect Addressing

- You can indirectly address the following: file number; element number; bit number
- Substitute address must be of type: N, T, C, R, B, I, O, S.
- Enter the address in brackets [ ]

Examples:

Indirect Address	Variable
N[N7:0]	file number
N7:[C5:7.ACC]	element number
B3:/[I:017]	bit number

I/O Addressing Modes

2-slot addressing	1-slot addressing	1/2-slot addressing
• two I/O module slots = 1 group • each physical 2-slot I/O group corresponds to one word (16 bits) in the input image table and one word (16 bits) in the output image table	• one I/O module slot = 1 group • each physical slot in the chassis corresponds to one word (16 bits) in the input image table and one word (16 bits) in the output image table	• one half of an I/O module slot = 1 group • each physical slot in the chassis corresponds to two words (32 bits) in the input image table and two words (32 bits) in the output image table

Discrete I/O Module Placement for Addressing Modes

I/O	2-slot addressing	1-slot addressing	1/2-slot addressing
8-pt modules	no restriction on module placement	no restriction on module placement, but does not make best use of I/O image and available I/O addresses	no restriction on module placement, but does not make best use of I/O image and available I/O addresses
16-pt modules	must use 1 input and 1 output module per even/odd slot pair	no restriction on module placement	no restriction on module placement, but does not make best use of I/O image and available I/O addresses
32-pt modules	not allowed	must use 1 input and 1 output module per even/odd slot pair	no restriction on module placement

Addressing Concept Summary

If you are using this chassis size:	2-slot addressing	1-slot addressing	1/2-slot addressing
4-slot	1/4 rack	1/2 rack	1 rack
8-slot	1/2 rack	1 rack	2 racks
12-slot	3/4 rack	1 1/2 racks	3 racks
16-slot	1 rack	2 racks	4 racks

Instruction Set – Status Bits

Status Bits:

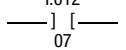
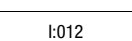
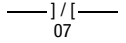
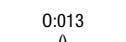
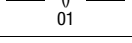
- .EN – enable
- .TT – timing
- .DN – done
- .OV – overflow
- .UN – underflow
- .EU – unload enable
- .FD – found
- .UL – unload
- .ER – error
- .EM – empty
- .CD – count down enable
- .CU – count up enable
- .IN – inhibit
- .EU – queue

Category	Mnemonic			Word 0								Word 1	Word 2
				15	14	13	12	11	10	09	08		
TIMER (T4:*n*) [2]	TON	TOF	RTO	EN	TT	DN						.PRE	.ACC
COUNTER (C5:*n*) [2]	CTU	CTD		CU	CD	DN	OV	UN				.PRE	.ACC
FILE (R6:*n*) [2]	FAL			EN		DN		ER				.LEN	.POS
	FSC			EN		DN		ER		IN	FD	.LEN	.POS
	FFL	FFU		EN	EU	DN	EM					.LEN	.POS
	LFL [1]	LFU [1]		EN	EU	DN	EM					.LEN	.POS
	BSL	BSR		EN		DN		ER	UL			.LEN	.POS
	FBC	DDT		EN		DN		ER		IN	FD	.LEN	.POS
	SQI	SQO	SQL	EN		DN		ER				.LEN	.POS
ASCII (R6:*n*) [2]	ARL [1]	AWT [1]	AWA [1]	EN	EU	DN	EM	ER	UL			.LEN	.POS
	AHL [1]			EN		DN	EM	ER			FD		
	ACB [1]	ABL [1]		EN	EU	DN	EM	ER			FD		
COMPUTE (R6:*n*) [2]	AVE [1]	SRT [1]	STD [1]	EN		DN		ER				.LEN	.POS

[1] Enhanced, Ethernet, and ControlNet PLC-5 processors only

[2] *n* = starting structure number 0-999

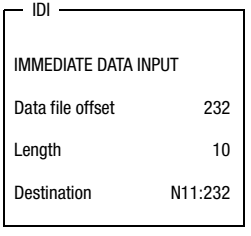
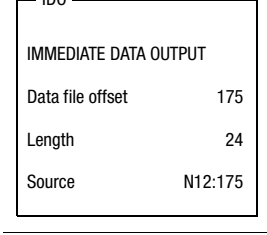
Relay Instructions

Instruction		Description
	Examine On XIC	Examine data table bit I:012/07, which corresponds to terminal 7 of an input module in I/O rack 1, I/O group 2. If this data table bit is set (1), the instruction is true.
	Examine Off XIO	Examine data table bit I:012/07, which corresponds to terminal 7 of an input module in I/O rack 1, I/O group 2. If this data table bit is reset (0), the instruction is true.
	Output Energize OTE	If the input instructions preceding this output instruction on the same rung go true, set (1) bit 0:013/01, which corresponds to terminal 1 of an output module in I/O rack 1, I/O group 3.
	Output Latch OTL	If the input conditions preceding this output instruction on the same rung go true, set (1) bit 0:013/01, which corresponds to terminal 1 of an output module in I/O rack 1, I/O group 3. This data table bit remains set until an OTU instruction resets the bit.
	Output Unlatch OTU	If the input conditions preceding this output instruction on the same rung go true, reset (0) bit 0:013/01, which corresponds to terminal 1 of an output module in I/O rack 1, I/O group 3. This is necessary to reset a bit that has been latched on.

relay instructions continued...

Instruction		Description
01 (IIN)	Immediate Input IIN	This instruction updates a word of input–image bits before the next normal input-image update. For a local chassis, program scan is interrupted while the inputs of the addressed I/O group are scanned; for a remote or ControlNet chassis, program scan is interrupted only to update the input image with the latest states as found in the remote I/O or ControlNet buffer.
01 (IOT)	Immediate Output IOT	This instruction updates a word of output–image bits before the next normal output-image update. For a local chassis, program scan is interrupted while the outputs of the addressed I/O group are scanned; for a remote or ControlNet chassis, program scan is interrupted only to update the remote I/O or ControlNet buffer with the latest states as found in the output image.

relay instructions continued...

Instruction		Description
	Immediate Data Input IDI for ControlNet processors only	If the input conditions are true, an immediate data input is initiated that updates the destination file from the private ControlNet buffers before the next normal input-image update. The Data file offset (232) is where the data is stored. The Length (10) identifies the number of words in the transfer – it can be an immediate value ranging from 1 to 64 or a logical address that specifies the number of words to be transferred. The Destination (N11:232) is the destination of the words to be transferred. The Destination should be the matching data-table address in the Data Input File (DIF) except when you use the instruction to ensure data-block integrity in the case of Selectable Timed Interrupts (STIs).
	Immediate Data Output IDO for ControlNet processors only	If the input conditions are true, an immediate data output is initiated that updates the private ControlNet output buffers from the source file before the next normal output-image update. The Data file offset (175) is the offset into the buffer where the data is stored. The Length (24) identifies the number of words in the transfer-it can be an immediate value ranging from 1 to 64 or a logical address that specifies the number of words to be transferred. The Source (N12:175) is the source of the words to be transferred. The Source should be the matching data-table address in the Data Output File (DOF) except when you use the instruction to ensure data-block integrity in the case of Selectable Timed Interrupts (STIs).

Timer Instructions

Instruction

Description

TON

TIMER ON DELAY

Timer	T4:1
Time Base	1.0
Preset	15
Accum	0

Timer On Delay
TON

Status Bits:
EN – Enable
TT – Timer Timing
DN – Done

If the input conditions go true, timer T4:1 starts incrementing in 1-second intervals. When the accumulated value is greater than or equal to the preset value (15), the timer stops and sets the timer done bit.

Rung Condition	EN 15	TT 14	DN 13	ACC Value	TON Status
False	0	0	0	0	Reset
True	1	1	0	increase	Timing
True	1	0	1	>=preset	Done

TOF

TIMER OFF DELAY

Timer	T4:1
Time Base	.01
Preset	180
Accum	0

Timer Off Delay
TOF

Status Bits:
EN – Enable
TT – Timer Timing
DN – Done

If the input conditions are false, timer T4:1 starts incrementing in 10 ms intervals as long as the rung remains false. When the accumulated value is greater than or equal to the preset value (180), the timer stops and resets the timer done bit.

Rung Condition	EN 15	TT 14	DN 13	ACC Value	TOF Status
True	1	0	1	0	Reset
False	0	1	1	increase	Timing
False	0	0	0	>=preset	Done

timer instructions continued...

Instruction		Description
RTO RETENTIVE TIMER ON Timer T4:10 Time Base 1.0 Preset 10 Accum 0	Retentive Timer On RTO Status Bits: EN - Enable TT - Timer Timing DN - Done	If the input conditions go true, timer T4:10 starts incrementing in 1-second intervals as long as the rung remains true. When the rung goes false, the timer stops. If the rung goes true again, the timer continues. When the accumulated value is greater than or equal to the preset (10), the timer stops and sets the timer done bit.
T4:1 (RES)	Timer Reset RES	If the input conditions go true, timer T4:1 is reset. This instruction resets timers and counters, as well as control blocks. This is necessary to reset the RTO accumulated value.

Rung Condition	EN 15	TT 14	DN 13	ACC Value	RTO Status
False	0	0	0	0	Reset
True	1	1	0	increase	Timing
False	0	0	0	maintains	Disabled
True	1	0	1	>=preset	Done

Instruction		Description
CTU COUNT UP Counter C5:1 Preset 10 Accum 0	Count Up CTU Status Bits: CU-Count Up CD-Count Down DN-Count Done OV-Overflow UN-Underflow	If the input conditions go true, counter C5:1 starts counting, incrementing by 1 every time the rung goes from false-to-true. When the accumulated value is greater than or equal to the preset value (10), the counter sets the counter done bit.

Rung Condition	CU 15	DN 13	OV 12	ACC Value	CTU Status
False	0	0	0	0	Reset
Toggle True	1	0	0	incr by 1	Counting
True	1	1	0	>=preset	Done
True	1	1	1	>32767	Overflow

counter instructions continued...

Instruction		Description
CTD COUNT DOWN Counter C5:1 Preset 10 Accum 35	Count Down CTD Status Bits: CU-Count Up CD-Count Down DN-Count Done OV-Overflow UN-Underflow	If the input conditions go true, counter C5:1 starts counting, decrementing by 1 every time the rung goes from false-to-true. When the accumulated value is less than or equal to the preset value (10), the counter resets the counter done bit.

Rung Condition	CD 14	DN 13	UN 11	ACC Value	CTD Status
False	0	0	0	0	Reset
False	0	1	0	>=preset	Preload
Toggle True	1	1	0	decr by 1	Counting
True	1	0	0	<preset	Done
True	1	0	1	<-32768	Underflow

C5:1 (RES)	Counter Reset RES	If the input conditions go true, counter C5:1 is reset. This instruction resets timers and counters, as well as control blocks.

Compare Instructions

Instruction		Description
CMP COMPARE Expression N7:5 = N7:10	Compare CMP	If the expression is true, this input instruction is true. The CMP instruction can perform these operations: equal (=), less than (<), less than or equal (<=), greater than (>), greater than or equal (>=), not equal (<>). Complex expressions (up to 80 characters) are valid with Enhanced and ControlNet PLC–5 processors only.
LIM LIMIT TEST (CIRC) Low limit N7:10 3 Test N7:15 4 High limit N7:20 22	Limit Test LIM	If the Test value (N7:15) is >= the Low Limit (N7:10) and <= the High Limit (N7:20), this instruction is true.

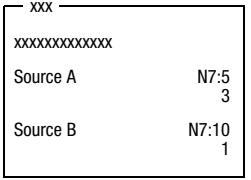
Low Limit	Test	High Limit	LIM
0	0	10	T
–5	5	10	T
5	11	10	F
10	0	0	T
10	5	–5	F
10	11	5	T

compare instructions continued...

Instruction		Description
MEQ MASKED EQUAL Source D9:5 0000 Mask D9:6 0000 Compare D9:10 0000	Mask Compare Equal MEQ	The processor takes the value in the Source (D9:5) and passes that value through the Mask (D9:6). Then the processor compares the result to the Compare value (D9:10). If the result and this comparison values are equal, the instruction is true.

Source	Mask	Compare	MEQ
0008	0008	0009	F
0008	0001	0001	F
0087	000F	0007	T
0087	00F0	0007	F

Instruction	Description



Source A	Source B	EQU	GEQ	GRT	LEQ	LES	NEQ
10	10	T	T	F	T	F	F
5	6	F	F	F	T	T	T
21	20	F	T	T	F	F	T
–30	–31	F	T	T	F	F	T
–15	–14	F	F	F	T	T	T

Equal to EQU	If the value in Source A (N7:5) is = to the value in Source B (N7:10), this instruction is true.
Greater than or Equal GEQ	If the value in Source A (N7:5) is > or = to the value in Source B (N7:10), this instruction is true.
Greater than GRT	If the value in Source A (N7:5) is > the value in Source B (N7:10), this instruction is true.
Less than or Equal LEQ	If the value in Source A (N7:5) is < or = to the value in Source B (N7:10), this instruction is true.
Less than LES	If the value in Source A (N7:5) is < the value in Source B (N7:10), this instruction is true.
Not Equal NEQ	If the value in Source A (N7:5) is not equal to the value in Source B (N7:10), this instruction is true.

Compute Instructions

Instruction		Description
CPT COMPUTE Dest N7:3 3 Expression N7:4 – (N7:6 * N7:10)	Compute CPT	If the input conditions go true, evaluate the Expression N7:4 – (N7:6 * N7:10) and store the result in the Destination (N7:3). The CPT instruction can perform these operations: add (+), subtract (–), multiply (*), divide (/), convert from BCD (FRD), convert to BCD (TOD), square root (SQR), logical and (AND), logical or (OR), logical not (NOT), exclusive or (XOR), negate (–), clear (0), and move. In addition, Enhanced PLC-5 processors can do: X to the power of Y (**), radians (RAD), degrees (DEG), log (LOG), natural log (LN), sine (SIN), cosine (COS), tangent (TAN), inverse sine (ASN), inverse cosine (ACS), inverse tangent (ATN). Complex expressions (up to 80 characters) are valid with Enhanced and ControlNet PLC-5 processors only.
ACS ARCCOSINE Source F8:19 0.7853982 Destination F8:20 0.6674572	Arc Cosine ACS (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	When the input conditions are true, take the arc cosine of the Source (F8:19) and store the result in the Destination (F8:20). The Source must be greater than or equal to –1 and less than or equal to 1. Status Bit / Description C – always resets V – sets if overflow is generated; otherwise resets Z – sets if the result is zero; otherwise resets S – always resets

Instruction		Description
ADD ADD Source A N7:3 3 Source B N7:4 1 Dest N7:12 4	Addition ADD	When the input conditions are true, add the value in Source A (N7:3) to the value in Source B (N7:4) and store the result in the Destination (N7:12). Status Bit: C — sets if carry is generated; otherwise resets V — sets if overflow is generated; otherwise resets Z — sets if the result is zero; otherwise resets S — sets if the result is negative; otherwise resets
ASN ARCSINE Source F8:17 0.7853982 Destination F8:18 0.9033391	Arc Sine ASN (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	When the input conditions are true, take the arc sine of the Source (F8:17) and store the result in the Destination (F8:18). The Source is interpreted as radians and must be greater than or equal to -1 and less than or equal to 1. Status Bit: C — always resets V — sets if overflow is generated; otherwise resets Z — sets if the result is zero; otherwise resets S — always resets

compute instructions continued...

Instruction		Description
ATN ARCTANGENT Source F8:21 0.7853982 Destination F8:22 0.6657737	Arc Tangent ATN (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	When the input conditions are true, take the arc tangent of the Source (F8:21) and store the result in the Destination (F8:22). The Source is interpreted as radians. C: always resets V: sets if overflow is generated; otherwise resets Z: sets if the result is zero; otherwise resets S: sets if the result is negative; otherwise resets
AVE AVERAGE FILE File #N7:1 Dest N7:0 Control R6:0 Length 4 Position 0	Average AVE (Enhanced, Ethernet, and ControlNet PLC-5 processors only) Status Bits: EN-Enable DN-Done Bit ER-Error Bit	When the input conditions go from false-to-true, add N7:1, N7:2, N7:3, and N7:4. Divide the sum by 4 and store the result in N7:0. C: always resets V: sets if overflow is generated; otherwise resets Z: sets if the result is zero; otherwise resets S: sets if the result is negative; otherwise resets

Instruction		Description
CLR CLR Dest D9:34 0000	Clear CLR	When the input conditions are true, clear BCD file 9, word 34 (set to zero). Status Bit: C — always reset; V — always reset; Z — always set; S — always reset
COS COSINE Source F8:13 0.7853982 Destination F8:14 0.7071068	Cosine COS (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	When the input conditions are true, take the cosine of the Source (F8:13) and store the result in the Destination (F8:14). The Source is interpreted as radians. Status Bit: C — always resets; V — sets if overflow is generated; otherwise resets; Z — sets if the result is zero; otherwise resets; S — sets if the result is negative; otherwise resets

compute instructions continued...

Instruction		Description
DIV DIVIDE Source A N7:3 3 Source B N7:4 1 Dest N7:12 3	Division DIV	When the input conditions are true, divide the value in Source A (N7:3) by the value in Source B (N7:4) and store the result in the Destination (N7:12). Status Bit: C — always resets V — sets if division by zero or overflow; otherwise resets Z — sets if the result is zero; otherwise resets S — sets if the result is negative; otherwise resets
LN NATURAL LOG Source N7:0 5 Destination F8:20 1.609438	Natural Log LN (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	When the input conditions are true, take the natural log of the Source (N7:0) and store the result in the Destination (F8:20). The Source must be positive (greater than 0). Status Bit: C — always resets V — sets if overflow is generated; otherwise resets Z — sets if the result is zero; otherwise resets S — sets if the result is negative; otherwise resets

Instruction		Description
LOG LOG BASE 10 Source N7:2 5 Destination F8:3 0.6989700	Log to the Base 10 LOG (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	When the input conditions are true, take the log base 10 of the Source (N7:2) and store the result in the Destination (F8:3). The Source must be positive (greater than 0). Status Bit: C — always resets V — sets if overflow is generated; otherwise resets Z — sets if the result is zero; otherwise resets S — sets if the result is negative; otherwise resets
MUL MULTIPLY Source A N7:3 3 Source B N7:4 1 Dest N7:12 3	Multiply MUL	When the input conditions are true, multiply the value in Source A (N7:3) by the value in Source B (N7:4) store the result in the Destination (N7:12). Status Bit: C — always resets V — sets if overflow is generated; otherwise resets Z — sets if the result is zero; otherwise resets S — sets if the result is negative; otherwise resets

compute instructions continued...

Instruction		Description
NEG NEGATE Source N7:3 3 Destination N7:12 –3	Negate NEG	When the input conditions are true, take the opposite sign of the Source (N7:3) and store the result in the Destination (N7:12). This instruction turns positive values into negative values and negative values into positive values. Status Bit: C — sets if the operation generates a carry; otherwise resets V — sets if overflow is generated; otherwise resets Z — sets if the result is zero; otherwise resets S — sets if the result is negative; otherwise resets
SIN SINE Source F8:11 0.7853982 Destination F8:12 0.7071068	Sine SIN (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	When the input conditions are true, take the sine of the Source (F8:11) and store the result in the Destination (F8:12). The Source is interpreted as radians. Status Bit: C — always resets V — sets if overflow is generated; otherwise resets Z — sets if the result is zero; otherwise resets S — sets if the result is negative; otherwise resets

Instruction		Description
SQR SQUARE ROOT Source N7:3 25 Destination N7:12 5	Square Root SQR	When the input conditions are true, take the square root of the Source (N7:3) and store the result in the Destination (N7:12). Status Bit: C — always resets V — sets if overflow occurs during floating point to integer conversion; otherwise resets Z — sets if the result is zero; otherwise resets S — always resets
SRT SORT File #N7:1 Control R6:0 Length 4 Position 0	Sort SRT (Enhanced, Ethernet, and ControlNet PLC-5 processors only) Status Bits: EN - Enable DN - Done Bit ER - Error Bit	When the input conditions go from false-to-true, the elements in N7:1, N7:2, N7:3.and N7:4 are sorted into ascending order.

compute instructions continued...

Instruction		Description
STD STANDARD DEVIATION File #N7:1 Dest N7:0 Control R6:0 Length 4 Position 0	Standard Deviation STD (Enhanced, Ethernet, and ControlNet PLC-5 processors only) Status Bits: EN - Enable DN - Done Bit ER - Error Bit	When the input conditions go from false-to-true, the elements in N7:1, N7:2, N7:3 and N7:4 are used to calculate the standard deviation of the values and store the result in the Destination (N7:0). The result is stored in N7:0. C: always resets V: sets if overflow is generated; otherwise resets Z: sets if the result is zero; otherwise resets S: sets if the result is negative; otherwise resets
SUB SUBTRACT Source A N7:33 Source B N7:41 Dest N7:122	Subtract SUB	When the input conditions are true, subtract the value in Source B (N7:4) from the value in Source A (N7:3) and store the result in the Destination (N7:12). C: sets if borrow is generated; otherwise resets V: sets if underflow is generated; otherwise resets Z: sets if the result is zero; otherwise resets S: sets if the result is negative; otherwise resets

Instruction		Description
TAN TANGENT Source F8:15 0.7853982 Destination F8:16 1.0000000	Tangent TAN (Enhanced, Ethernet and ControlNet PLC-5 processors only)	When the input conditions are true, take the tangent of the Source (F8:15) and store the result in the Destination (F8:16). The Source must be greater than or equal to –102943.7 and less than or equal to 102943.7. The Source is interpreted as radians.

Status Bit	Description
C	always resets
V	sets if overflow is generated; otherwise resets
Z	sets if the result is zero; otherwise resets
S	sets if the result is negative; otherwise resets

Logical Instructions

Instruction		Description
AND BITWISE AND Source A D9:3 3F37 Source B D9:4 00FF Dest D9:5 0037	AND	When the input conditions are true, the processor evaluates an AND operation (bit-by-bit) between Source A (D9:3) and Source B (D9:4) and stores the result in the Destination (D9:5). The truth table for an AND operation is: Source A / Source B / Result 0 / 0 / 0 1 / 0 / 0 0 / 1 / 0 1 / 1 / 1
NOT NOT Source A D9:3 00FF Destination D9:5 FF00	NOT Operation	When the input conditions are true, the processor performs a NOT (takes the opposite of) operation (bit-by-bit) on the Source (D9:3) and stores the result in the Destination (D9:5). The truth table for a NOT operation is: Source / Destination 0 / 1 1 / 0

Status Bit	Description
C	always resets
V	always resets
Z	sets if the result is zero; otherwise resets
S	sets if the most significant bit (bit 15 for decimal or bit 17 for octal) is set (1); otherwise resets

Instruction		Description
OR BITWISE INCLUS OR Source A D9:3 3F37 Source B D9:4 00FF Dest D9:5 3FFF	OR	When the input conditions are true, the processor evaluates an OR operation (bit-by-bit) between Source A (D9:3) and Source B (D9:4) and stores the result in the Destination (D9:5). The truth table for an OR operation is: Source A / Source B / Result 0 / 0 / 0 1 / 0 / 1 0 / 1 / 1 1 / 1 / 1
XOR BITWISE EXCLUS OR Source A D9:3 3F37 Source B D9:4 3F37 Dest D9:5 0000	Exclusive OR XOR	When the input conditions are true, the processor evaluates an exclusive OR operation (bit-by-bit) between Source A (D9:3) and Source B (D9:4) and stores the result in the Destination (D9:5). The truth table for an XOR operation is: Source A / Source B / Result 0 / 0 / 0 1 / 0 / 1 0 / 1 / 1 1 / 1 / 0

Status Bit	Description
C	always resets
V	always resets
Z	sets if the result is zero; otherwise resets
S	sets if the most significant bit (bit 15 for decimal or bit 17 for octal) is set (1); otherwise resets

Conversion Instructions

Instruction		Description
FRD FROM BCD Source D9:3 0037 Destination N7:12 37	Convert from BCD FRD	When the input conditions are true, convert the value in the Source (D9:3) to an integer value and store the result in the Destination (N7:12). The source must be in the range of 0-9999 (BCD). Status Bit: C — always resets V — always resets Z — sets if the destination value is zero; otherwise resets S — always resets
TOD TO BCD Source N7:3 44 Destination D9:5 0044	Convert to BCD TOD	When the input conditions are true, convert the value in Source (N7:3) to a BCD format and store the result in the Destination (D9:5). Status Bit: C — always resets V — sets if the source value is negative or greater than 9999 (i.e., outside of the range of 9999) Z — sets if the destination value is zero; otherwise resets S — always resets

Instruction

Description

DEG

RADIANS TO DEGREE

Source F8:7 0.7853982

Destination F8:8 45

Convert to Degrees
DEG

(Enhanced, Ethernet, and ControlNet PLC-5 processors only)

Converts radians (the value in Source A) to degrees and stores the result in the Destination (Source times 180/π).

Status Bit	Description
C	always resets
V	sets if overflow is generated; otherwise resets
Z	sets if the result is zero; otherwise resets
S	sets if the result is negative; otherwise resets

RAD

DEGREES TO RADIAN

Source N7:9 45

Destination F8:10 0.7853982

Convert to Radians
RAD

(Enhanced, Ethernet, and ControlNet PLC-5 processors only)

Converts degrees (the value in Source A) to radians and stores the result in the Destination (Source times π/180).

Status Bit	Description
C	always resets
V	sets if overflow is generated; otherwise resets
Z	sets if the result is zero; otherwise resets
S	sets if the result is negative; otherwise resets

Bit Modify and Move Instructions

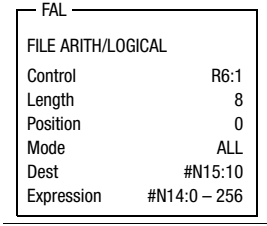
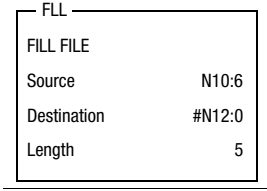
Instruction		Description
BTD BIT FIELD DISTRIB Source N7:3 0 Source bit 3 Dest N7:4 0 Dest bit 10 Length 6	Bit Distribute BTD	When the input conditions are true, the processor copies the number of bits specified by Length, starting with the Source bit (3) of the Source (N7:3), and placing the values in the Destination (N7:4), starting with the Destination bit (10).
MOV MOVE Source N7:3 0 Destination N7:12 0	Move MOV	When the input conditions are true, move a copy of the value in Source (N7:3) to the Destination (N7:12). This overwrites the original value in the Destination.

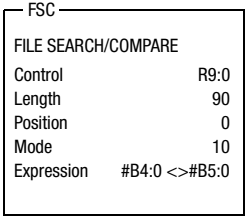
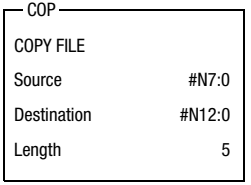
Status Bit	Description
C	always resets
V	sets if overflow is generated during floating point-to-integer conversion; otherwise resets
Z	sets if the destination value is zero; otherwise resets
S	sets if the result is negative; otherwise resets

Instruction		Description
MVM MASKED MOVE Source D9:3 478F Mask D9:5 00FF Dest bit D9:12 Length 008F	Masked Move MVM	When the input conditions are true, the processor passes the value in the Source (D9:3) through the Mask (D9:5) and stores the result in the Destination (D9:12). This overwrites the original value in the Destination.

Status Bit	Description
C	always resets
V	always resets
Z	sets if the result is zero; otherwise resets
S	sets if the result is negative; otherwise resets

File Instructions

Instruction		Description
	File Arithmetic and Logic FAL Status Bits: EN – Enable DN – Done Bit ER – Error Bit	When the input conditions go from false-to-true, the processor reads 8 elements of N14:0, and subtracts 256 (a constant) from each element. This example shows the result being stored in the eight elements beginning with N15:10. The control element R6:1 controls the operation. The Mode determines whether the processor performs the expression on all elements in the files (ALL) per program scan, one element in the files (INC) per scan, or a specific number of elements (NUM) per scan. The FAL instruction can perform these operations: add (+), subtract (–), multiply (*), divide (/), convert from BCD (FRD), convert to BCD (TOD), square root (SQR), logical and (AND), logical or (OR), logical not (NOT), exclusive or (XOR), negate (–), clear (0), move, and the new math instructions (see the CPT list).
	File Fill FLL	When the input conditions are true, the processor copies the value in Source (N10:6) to the elements in the Destination file (#N12:0). The FLL instruction only fills as many elements in the destination as specified in the Length.

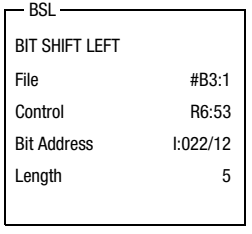
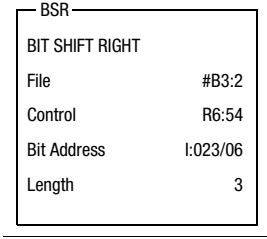
Instruction		Description
	File Search and Compare FSC Status Bits: EN - Enable DN - Done Bit ER - Error Bit IN - Inhibit Bit FD - Found Bit	When the input conditions go from false-to-true, the processor performs the not-equal-to comparison on 10 elements per scan for 9 scans (numeric mode) between files B4:0 and B5:0. The Mode determines whether the processor performs the expression on all elements in the files (ALL) per program scan, one element in the files (INC) per scan, or a specific number of elements (number) per scan. The control element R9:0 controls the operation. When the corresponding source elements are not equal (element B4:4 and B5:4 in this example), the processor stops the search and sets the found.FD and inhibit.IN bits so your ladder program can take appropriate action. To continue the search comparison, you must reset the.IN bit. To see a list of the available comparisons, see the comparisons listed under the CMP instruction.
	File Copy COP	When the input conditions are true, the processor copies the contents of the Source file (#N7:0) into the Destination file (#N12:0). The source remains unchanged. The COP instruction copies the number of elements from the source as specified by the Length.

Diagnostic Instructions

Instruction		Description
FBC FILE BIT COMPARE Source #I:031 Reference #B3:1 Result #N7:0 Cmp Control R6:4 Length 48 Position 0 Result Control R6:5 Length 10 Position 0	File Bit Compare FBC Status Bits: EN - Enable DN - Done Bit ER - Error Bit IN - Inhibit Bit FD - Found Bit	When the input conditions go from false-to-true, the processor compares the number of bits specified in the Cmp Control Length (48) of the Source file (#I:031) with the bits in the Reference file (#B3:1). The processor stores the results (mismatched bit numbers) in the Result file (#N7:0). File R6:4 controls the compare and file R6:5 controls the file that contains the results. The file containing the results can hold up to 10 (the number specified in the Length field) mismatches between the compared files.

Instruction		Description
DDT DIAGNOSTIC DETECT Source #I:030 Reference #B3:1 Result #N10:0 Cmp Control R6:0 Length 20 Position 0 Result Control R6:1 Length 5 Position 0	Diagnostic Detect DDT Status Bits: EN - Enable DN - Done Bit ER - Error Bit IN - Inhibit Bit FD - Found Bit	When the input conditions go from false-to-true, the processor compares the number of bits specified in the Cmp Control Length (20) of the Source file (#I:031) with the bits in the Reference file (#B3:1). The processor stores the results (mismatched bit numbers) in the Result file (#N10:0). File R6:0 controls the compare and file R6:1 controls the file that contains the results (#N10:0). The file containing the results can hold up to 5 (the number specified in the Length field) mismatches between the compared files. The processor copies the source bits to the reference file for the next comparison. The difference between the DDT and FBC instruction is that each time the DDT instruction finds a mismatch, the processor changes the reference bit to match the source bit. You can use the DDT instruction to update your reference file to reflect changing machine or process conditions.
DTR DATA TRANSITION Source I:002 Mask 0FFF Reference N63:11	Data Transition DTR	The DTR instruction compares the bits in the Source (I:002) through a Mask (0FFF) with the bits in the Reference (N63:11). When the masked source is different than the reference, the instruction is true for only 1 scan. The source bits are written into the reference address for the next comparison. When the masked source and the reference are the same, the instruction remains false.

Shift Register Instructions

Instruction		Description
	Bit Shift Left BSL Status Bits: EN - Enable DN - Done Bit ER - Error Bit UL - Unload Bit	If the input conditions go from false-to-true, the BSL instruction shifts the number of bits specified by Length (5) in File (B3), starting at bit 16 (B3:1/0 = B3/16), to the left by one bit position. The source bit (I:022/12) shifts into the first bit position, B3:1/0 (B3/16). The fifth bit, B3:1/4 (B3/20), is shifted into the UL bit of the control structure (R6:53).
	Bit Shift Right BSR Status Bits: EN - Enable DN - Done Bit ER - Error Bit UL - Unload Bit	If the input conditions go from false-to-true, the BSR instruction shifts the number of bits specified by Length (3) in File (B3), starting with B3:2/0 (=B3/32), to the right by one bit position. The source bit (I:023/06) shifts into the third bit position B3/34. The first bit (B3/32) is shifted into the UL bit of the control element (R6:54).

Instruction		Description
FFL FIFO LOAD Source N60:1 FIFO #N60:3 Control R6:51 Length 64 Position 0	FIFO Load FFL Status Bits: EN - Enable Load DN - Done Bit EM - Empty Bit	When the input conditions go from false-to-true, the processor loads N60:1 into the next available element in the FIFO file, #N60:3, as pointed to by R6:51. Each time the rung goes from false-to-true, the processor loads another element. When the FIFO file (stack) is full, (64 words loaded), the DN bit is set.
FFU FIFO UNLOAD FIFO #N60:3 Dest N60:2 Control R6:51 Length 64 Position 0	FIFO Unload FFU Status Bits: EU - Enable Unload DN - Done Bit EM - Empty Bit	When the input conditions go from false-to-true, the processor unloads an element from N60:3 into N60:2. Each time the rung goes from false-to-true, the processor unloads another element. All the data in file #N60:3 is shifted one position toward N60:3. When the file is empty, the EM bit is set.

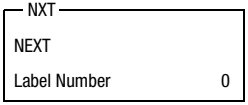
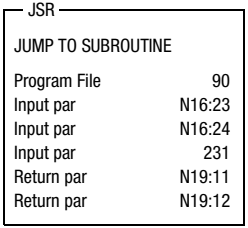
shift register instructions continued...

Instruction		Description
LFL LIFO LOAD Source N70:1 LIFO #N70:3 Control R6:61 Length 64 Position 0	LIFO Load LFL (Enhanced, Ethernet, and ControlNet PLC-5 processors only) Status Bits: EN - Enable Load DN - Done Bit EM - Empty Bit	When the input conditions go from false-to-true, the processor loads N70:1 into the next available element in the LIFO file #N70:3, as pointed to by R6:61. Each time the rung goes from false-to-true, the processor loads another element. When the LIFO file (stack) is full (64 words have been loaded), the DN bit is set.
LFU LIFO UNLOAD LIFO #N70:3 Dest N70:2 Control R6:61 Length 64 Position 0	LIFO Unload LFU (Enhanced, Ethernet, and ControlNet PLC-5 processors only) Status Bits: EN - Enable Load EU - Enable Unload DN - Done Bit EM - Empty Bit	When the input conditions go from false-to-true, the processor unloads the last element from #N70:3 and puts it into N70:2. Each time the rung goes from false-to-true, the processor unloads another element. When the LIFO file is empty, the EM bit is set.

Instruction		Description
SQI SEQUENCER INPUT File #N7:11 Mask FFF0 Source #I:031 Control R6:21 Length 4 Position 0	Sequencer Input SQI	The SQI instruction compares the Source (#I:031) input image data through a Mask (FFF0) to Reference data (#N7:11) to see if the two files are equal. The operation is controlled by the information in the control file R6:21. When the status of all unmasked bits of the word pointed to by control element R6:21 matches the corresponding reference bits, the rung instruction goes true.
SQL SEQUENCER LOAD File #N7:20 Source I:002 Control R6:22 Length 5 Position 0	Sequencer Load SQL Status Bits: EN – Enable DN – Done Bit ER - Error Bit	The SQL instruction loads data into the sequencer File (#N7:20) from the source word (I:002) by stepping through the number of elements specified by Length (5) of the Source (I:002), starting at the Position (0). The operation is controlled by the information in the control file R6:22. When the rung goes from false-to-true, the SQL instruction increments the next step in the sequencer file and loads the data into it for every scan that the rung remains true.
SQO SEQUENCER OUTPUT File #N7:1 Mask 0F0F Dest 0:014 Control R6:20 Length 4 Position 0	Sequencer Output SQO Status Bits: EN – Enable DN – Done Bit ER - Error Bit	When the rung goes from false-to-true, the SQO instruction increments to the next step in the sequencer File (#N7:1). The data in the sequencer file is transferred through a Mask (0F0F) to the Destination (0:014) for every scan that the rung remains true.

Program Control Instructions

Instruction		Description
—— (MCR) ——	Master Control Reset MCR	If the input conditions are true, the program scans the rungs between MCR instruction rungs and processes the outputs normally. If the input conditions are false, all non-retentive outputs between the MCR-instruction rungs are reset.
10 —— (JMP) ——	Jump JMP	If the input conditions are true, the processor skips rungs by jumping to the rung identified by the label (10).
10 —— [LBL] ——	Label LBL	When the processor reads a JMP instruction that corresponds to label 10, the processor jumps to the rung containing the label and starts executing. (Must be the first instruction on a rung.)
FOR FOR Label Number 0 Index N7:0 Initial Value 0 Terminal Value 10 Step Size 1	FOR Loop FOR	The processor executes the rungs between the FOR and the NXT instruction repeatedly in one program scan, until it reaches the terminal value (10) or until a BRK instruction aborts the operation. Step size is how the loop is incremented.

Instruction		Description
	Next NXT	The NXT instruction returns the processor to the corresponding FOR instruction, identified by the label number specified in the FOR instruction. NXT must be programmed on an unconditional rung that is the last rung to be repeated in a For-Next loop.
	Break BRK	When the input conditions go true, the BRK instruction aborts a For-Next loop.
	Jump to Subroutine JSR	If the input conditions are true, the processor starts running a subroutine Program File (90). The processor uses the Input Parameters (N16:23, N16:24, 231) in the subroutine and passes Return Parameters (N19:11, N19:12 back to the main program, where the processor encountered the JSR instruction.

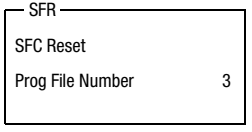
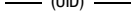
program control instructions continued...

Instruction		Description
SBR SUBROUTINE Input par N43:0 Input par N43:1 Input par N43:2	Subroutine SBR	The SBR instruction is the first instruction in a subroutine file. This instruction identifies Input Parameters (N43:0, N43:1, N43:2) the processor receives from the corresponding JSR instruction. You do not need the SBR instruction if you do not pass input parameters to the subroutine.
RET RETURN () Return par N43:3 Return par N43:4	Return RET	The RET instruction ends the subroutine and stores the Return Parameters (N43:3, N43:4) to be returned to the JSR instruction in the main program.
(TND)	Temporary End TND	The TND instruction stops the processor from scanning the rest of the program (i.e., this instruction temporarily ends the program).
[AFI]	Always False AFI	The AFI instruction disables the rung (i.e., the rung is always false).
B3 [ONS] 110	One Shot ONS	If the input conditions preceding the ONS instructions on the same rung go from false-to-true, the ONS instruction conditions the rung so that the output is true for one scan. The rung is false on successive scans.

Instruction		Description
OSF ONE SHOT FALLING Storage Bit B3/0 Output Bit 15 Output Word N7:0	One Shot Falling OSF (Enhanced, Ethernet, and ControlNet PLC-5 processors only) Status Bits: OB - Output Bit [1] SB - Storage Bit [1]	The OSF instruction triggers an event to occur one time. Use the OSF instruction whenever an event must start based on the change of state of a rung from true-to-false, not on the resulting rung status. The output bit (N7:0/15) is set (1) for one program scan when the rung goes from true-to-false.
OSR ONE SHOT RISING Storage Bit B3/0 Output Bit 15 Output Word N7:0	One Shot Rising OSR (Enhanced, Ethernet, and ControlNet PLC-5 processors only) Status Bits: OB - Output Bit [1] SB - Storage Bit [1]	The OSR instruction triggers an event to occur one time. Use the OSR instruction whenever an event must start based on the change of state of a rung from false-to-true, not on the resulting rung status. The output bit (N7:0/15) is set (1) for one program scan when the rung goes from false-to-true.

[1] These bits are for display purposes only; there is no logical address for them.

Program control instructions continued...

Instruction		Description
	SFC Reset SFR (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	The SFR instruction resets the logic in a sequential function chart. When the SFR instruction goes true, the processor performs a lastscan/postscan on all active steps and actions in the selected file, and then resets the logic in the SFC on the next program scan. The chart remains in this reset state until the SFR instruction goes false.
	End of Transition EOT	The EOT instruction should be the last instruction in a transition file. If you do not use an EOT instruction, the processor always evaluates the transition as true.
	User Interrupt Disable UID (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	The UID instruction temporarily disables an interrupt-driven ladder program (such as an STI or PII) from interrupting the currently executing program.
	User Interrupt Enable UIE (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	The UIE instruction re-enables the interrupt-driven ladder program to interrupt the currently executing ladder program.

Instruction		Description
PID PID Control Block N10:0 Proc Variable N15:13 Tieback N15:14 Control Output N20:21	Proportional, Integral, and Derivative PID Status Bits: EN - Enable DN - Done Bit	If the input conditions go false-to-true, the processor performs PID calculations and calculates a new control output (for Classic PLC-5 processors). The control block (N10:0) contains the instruction information for the PID. The PID gets the process variable from N15:13 and sends the PID output to N20:21. The tieback stored in N15:14 handles the manual control station. For Enhanced, Ethernet, and ControlNet PLC-5 processors, you can use the PD control block. (If you use PD control block, then there is no done bit.) Also, the rung input conditions only need to be true for these processors.
MSG SEND/RECEIVE MSG Control Block N7:10	Message MSG Bit # / Status Bits 15 EN - Enable 14 ST - Start Bit 13 DN - Done Bit 12 ER - Error Bit 11 CO - Continuous 10 EW - Enabled-Waiting 9 NR - No Response 8 TO - Time Out Bit	If the input conditions are true, the data is transferred according to the instruction parameters you set when you entered the message instruction. The Control Block (N7:10) contains status and instruction parameters. For Enhanced, Ethernet, and ControlNet PLC-5 processors, you can use the MG control block.

Processor control and message instructions continued...

Instruction		Description
MSG SEND/RECEIVE MESSAGE Control block MG10:10	Message MSG Status Bits TO - Time-Out Bit EW - Enabled-Waiting Bit CO - Continuous Bit ER - Error Bit DN - Done Bit ST - Start Bit EN - Enable Bit	If the input conditions go from false to true, the data is transferred according to the instruction parameters you set when you enter the message instruction. The Control Block (MG10:10) contains status and instruction parameters. You cannot use N (integer) control blocks on the ControlNet network. For continuous MSGs, condition the rung to be true for only one scan.

Integer (N) control block

Word Offset	Description
0	status bits (see below)
1	requested word count
2	transmitted word count
3	file number
4	element number

Block Transfer (BT) control block

Word Mnemonic	Description
.EN thru.RW	status bits
.RLEN	requested length
.DLEN	transmitted word length/error code
.FILE	file number
.ELEM	element number
.RGS	rack/group/slot

Word 0

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
EN	ST	DN	ER	CO	EW	NR	TO	RW	**	rack	**	**	group	**	slot

block transfer instructions continued...

PLC-5/25, -5/30, -5/40, -5/40L, -5/40C, -5/60, -5/60L, -5/80, -5/40E, -5/80E, -5/80C processors		PLC-5/40, -5/40C, 5/60, -5/60L, -5/60C, -5/80, -5/40E, -5/80E, -5/80C processors		PLC-5/60, -5/80, -5/80E, -5/80C processors	
S:7 bit #	BT queue full for rack	S:32 bit #	BT queue full for rack	S:34 bit #	BT queue full for rack
08[1]	0	08	10	08	20
09[1]	1	09	11	09	21
10[1]	2	10	12	10	22
11[1]	3	11	13	11	23
12	4	12	14	12	24
13	5	13	15	13	25
14	6	14	16	14	26
15	7	15	17	15	27

[1] PLC-5/10, -5/11 -5/12, -5/15, -5/20, -5/20E, -5/20C processors also

Instruction		Description
BTR BLOCK TRNSFR READ Rack 1 Group 0 Module 0 Control Block N10:100 Data File N10:110 Length 40 Continuous Y	Block Transfer Read BTR	If the input conditions go from false-to-true, a block transfer read is initiated for the I/O module located at rack 1, group 0, module 0. The Control Block (N10:100 – 5-word file) contains status for the transfer. The Data File (N10:110) is where the data read from the module is stored. The BT Length (40) identifies the number of words in the transfer. A non-continuous block transfer is queued and run only once on a false-to-true rung transition; a continuous block transfer is repeatedly requeued. For Enhanced, Ethernet, and ControlNet PLC-5 processors, you can use the BT control block.
BTW BLOCK TRNSFR WRITE Rack 1 Group 0 Module 0 Control Block N10:0 Data File N10:10 Length 40 Continuous Y	Block Transfer Write BTW	If the input conditions go from false-to-true, the block transfer write is initiated for the I/O module located at rack 1, group 0, module 0. The Control Block (N10:0 - 5-word file) contains status for the transfer. The Data File contains the data to write to the module (N10:10). The BT Length (40) identifies the number of words in the transfer. A non-continuous block transfer is queued and run only once on a false-to-true rung transition; a continuous block transfer is repeatedly requeued. For Enhanced, Ethernet, and ControlNet PLC-5 processors, you can use the BT control block.

block transfer instructions continued...

Instruction		Description
CIO CNET I/O TRANSFER Control block CT21:50	ControlNet I/O Transfer CT Status Bits TO - Time-Out Bit EW - Enabled-Waiting Bit CO - Continuous Bit ER - Error Bit DN - Done Bit ST - Start Bit EN - Enable Bit	If the input conditions go from false to true, the data is transferred according to the instruction parameters you set when you enter the ControlNet I/O transfer instruction. The Control Block (CT21:50) contains status and instruction parameters. You cannot use N (integer) control blocks on the ControlNet network. For continuous CIOs, condition the rung to be true for only one scan.

Status Bits:

En – Enable	EM – Empty Bit
DN – Done Bit	EU – Queue
ER – Error Bit	FD – Found Bit

Instruction		Description
ABL ASCII TEST FOR LINE Channel 0 Control R6:32 Characters	ASCII Test for Line ABL (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	If input conditions go from false–to–true, the processor reports the number of characters in the buffer, up to and including the end–of–line characters and puts this value into the position word of the control structure (R6:32.POS). The processor also displays this value in the characters field of the display.
ACB ASCII CHARS IN BUFFER Channel 0 Control R6:32 Characters	ASCII Characters in Buffer ACB (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	If input conditions go from false–to–true, the processor reports the total number of characters in the buffer and puts this value into the position word (.POS) of the control structure. The processor also displays this value in the characters field of the display.
ACI ASCII STRING TO INT Source ST38:90 Dest N7:123 75	Convert ASCII String to Integer ACI (Enhanced, and Ethernet and ControlNet PLC-5 processors only)	If input conditions are true, the processor converts the string in ST38:90 to an integer and stores the result in N7:123. Status Bit | Description C | set if source is negative; otherwise resets V | set if source is >= 32,768 or <= –32,768, otherwise resets Z | sets if source is zero; otherwise resets S | set if destination is negative; otherwise resets

ASCII instructions continued...

Instruction		Description
ACN STRING CONCATENATE Source A ST38:90 Source B ST37:91 Dest ST52:76	ASCII String Concatenate ACN (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	If input conditions are true, the processor concatenates the string in ST38:90 with the string in ST37:91 and stores the result in ST52:76.
AEX STRING EXTRACT Source ST38:40 Index 42 Number 10 Dest ST52:75	ASCII String Extract AEX (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	If input conditions are true, the processor extracts 10 characters starting at the 42nd character of ST38:40 and stores the result in ST52:75.
AIC INTEGER TO STRING Source 876 Dest ST38:42	Convert Integer to ASCII String AIC (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	If input conditions are true, the processor converts the value 876 to a string and stores the result in ST38:42.

Instruction		Description
AHL ASCII HANDSHAKE LINE Channel 0 AND Mask 0001 OR Mask 0003 Control R6:23 Channel Status	ASCII Handshake Lines AHL (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	If input conditions go from false-to-true, the processor uses the AND and OR masks to determine whether to set or reset the DTR (bit 0) and RTS (bit 1) lines, or leave them unchanged. Bit 0 and 1 of the AND mask cause the line(s) to reset if 1 and leave the line(s) unchanged if 0. BIt 0 and 1 of the OR mask cause the line(s) to set if 1 and leave the line(s) unchanged if 0.
ARD ASCII READ Channel 0 Dest ST52:76 Control R6:32 String Length 50 Characters Read	ASCII Read ARD (Enhanced, Ethernet, and ControlNet PLC-5 processors only) Status Bits EN - Enable DN - Done Bit ER - Error Bit UL - Unload EM - Empty EU - Queue	If input conditions go from false-to-true, read 50 characters from the buffer and move them to ST52:76. The number of characters read is stored in R6:32.POS and displayed in the Characters Read Field of the instruction display.

ASCII instructions continued...

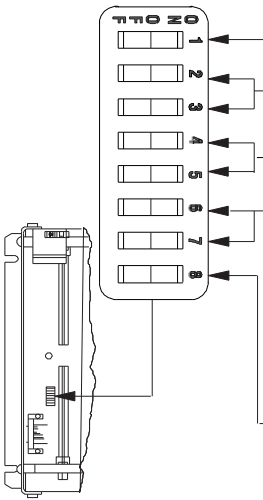
Instruction		Description
ARL ASCII READ LINE Channel Dest ST50:72 Control R6:30 String Length 18 Characters Read	ASCII Read Line ARL (Enhanced, Ethernet, and ControlNet PLC-5 processors only) Status Bits EN - Enable DN - Done Bit ER - Error Bit UL - Unload EM - Empty EU - Queue	If input conditions go from false-to-true, read 18 characters (or until end-of-line) from the buffer and move them to ST50:72. The number of characters read is stored in R6:30.POS and displayed in the Characters Read Field of the instruction display.
ASC STRING SEARCH Source ST38:40 Index 35 Search ST52:80 Result 42	ASCII String Search ASC (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	If input conditions are true, search ST52:80 starting at the 35th character, for the string found in ST38:40. In this example, the string was found at index 42. If the string is not found, the ASCII instruction minor fault bit S:17/8 is set and the result is zero.

Instruction		Description
ASR ASCII STRING COMPARE Source A ST37:42 Source B ST38:90	ASCII String Compare ASR (Enhanced, Ethernet, and ControlNet PLC-5 processors only)	If the string in ST37:42 is identical to the string in ST38:90, the instruction is true. Note that this is an input instruction. An invalid string length causes the ASCII instruction error minor fault bit S:17/8 to be set, and the instruction is false.
AWA ASCII WRITE APPEND Channel 0 Source ST52:76 Control R6:32 String Length 50 Characters Sent	ASCII Write Append AWA (Enhanced, Ethernet, and ControlNet PLC-5 processors only) Status Bits EN - Enable DN - Done Bit ER - Error Bit UL - Unload EM - Empty EU - Queue	If input conditions go from false-to-true, read 50 characters from ST52:76 and write it to channel 0 and append the two character configuration in the channel configuration (default CR/LF). The number of characters sent is stored in R6:32.POS and displayed in the characters sent field of the instruction display.

ASCII instructions continued...

Instruction		Description
AWT ASCII WRITE Channel 0 Source ST37:40 Control R6:23 String Length 40 Characters Sent	ASCII Write AWT (Enhanced, Ethernet, and ControlNet PLC-5 processors only) Status Bits EN - Enable DN - Done Bit ER - Error Bit UL - Unload EM - Empty EU - Queue	If input conditions go from false-to-true, write 40 characters from ST37:40 to channel 0. The number of characters sent is stored in R6:23.POS and displayed in the characters sent field of the instruction display.

Switch Assembly Settings for I/O Chassis Backplane
PLC-5 Processor in the I/O Chassis



Always Off

Switch	Last State
1	
ON	Outputs of this I/O chassis remain in their last state when a hardware failure occurs. [1]
OFF	Outputs of this I/O chassis are turned off when a hardware failure occurs. [1]

Switches		Addressing
4	5	
OFF	OFF	2-slot
OFF	ON	1-slot
ON	OFF	1/2-slot
ON	ON	Not allowed

Switches		EEPROM transfer
6	7	
OFF	OFF	EEPROM memory transfers to processor memory at powerup. [2]
ON	ON	EEPROM memory transfers to processor memory if processor memory not valid.
ON	OFF	EEPROM memory does not tranfer to processor memory. [3]

Switch	Processor memory protection
8	
OFF	Processor memory protection disabled.
ON	Processor memory protection enabled. [4]

Pressed in at top
Closed (ON)

Pressed in at bottom
Open (OFF)

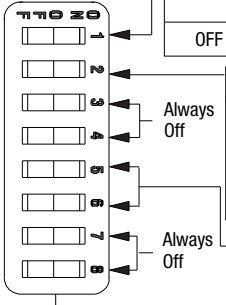
[1] Regardless of this switch setting, outputs are reset when either of the following occurs:
- processor detects a runtime error
- an I/O chassis backplane fault occurs
- you select program or test mode
- you set a status file bit to reset a local rack

[2] If an EEPROM module is not installed, the processor's PROC LED indicator blinks, and the processor sets S:11/9, in the major fault status word.

[3] A processor fault occurs if processor memory is not valid.

[4] You cannot clear processor memory when this switch is ON.

Switch Assembly Settings for I/O Chassis Backplane – 1771-ASB Remote I/O Adapter Module, 1771-ACN(R) and -ACN(R)15 ControlNet Adapter or 1771-ALX Extended Local I/O Adapter Module in the I/O Chassis



Switch 1	Last State
ON	Outputs of this I/O chassis remain in their last state when a communication fault is detected by this I/O adapter. **ATTENTION:** We recommend that you set switch 1 to the OFF position to de-energize outputs wired to this chassis when a fault is detected. Also, if outputs are controlled by inputs in a different rack and a remote I/O rack fault occurs (in the inputs rack), the inputs are left in their last non-faulted state. The outputs may not be properly controlled and potential personnel and machine damage may result. If you want your inputs to be anything other than their last non-faulted state, then you need to program a fault routine.
OFF	Outputs of this I/O chassis are turned off when a comunication fault is detected by this I/O adapter.

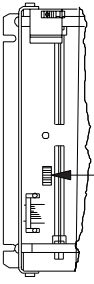
Always Off

Switch 2	Processor Restart Lockout
ON	Processor can restart the I/O chassis after a communication fault. Set this switch to ON if you plan to use I/O rack auto-configuration.
OFF	You must manually restart the I/O chassis with a switch wired to the 1771-AS or -ASB, or with the pushbutton mounted in the 1771-ALX.

Always Off

Switches		Addressing
5	6	
OFF	OFF	2-slot
ON	OFF	1-slot [1]
OFF	ON	1/2-slot [1,2]
ON	ON	Not allowed

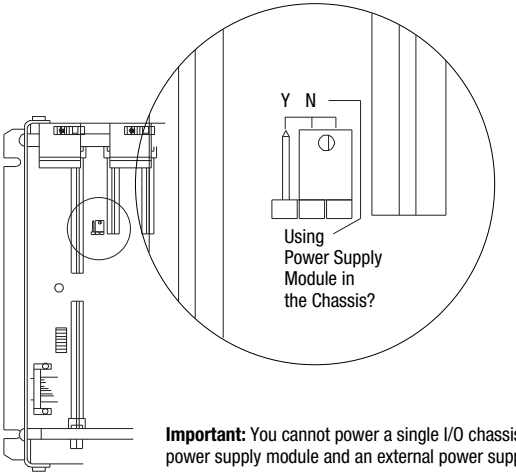
[1] The 1771-AS adapter does not support 1-slot or 1/2-slot addressing. When you use this adapter, set switches 5 and 6 to the OFF position.
[2] The 1771-ASB series A adapter does not support 1/2-slot addressing.

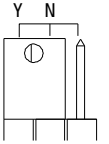


Pressed in at top
Closed (ON)

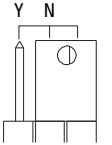
Pressed in at bottom
Open (OFF)

1771 I/O Chassis Configuration Plug Settings





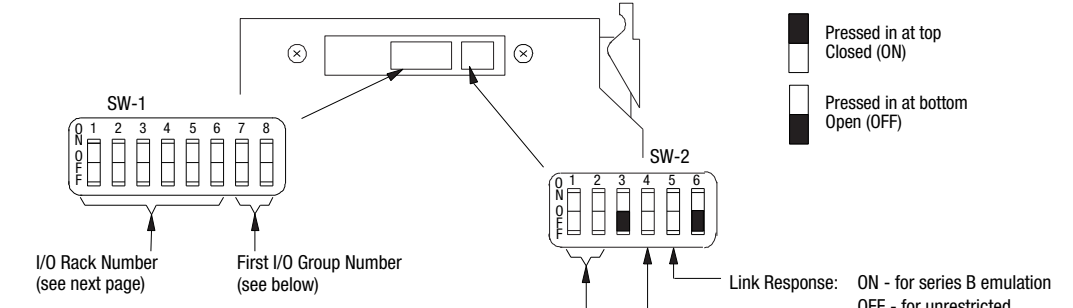
Set Y when you install a power supply module in the chassis.



Set N when you use an external power supply.

Important: You cannot power a single I/O chassis with both a power supply module and an external power supply.

Switch Assemblies without Complementary I/O in a Remote I/O Adapter Module (1771-ASB series C and series D)



Switch		Max chassis distance
1	2	
ON	OFF	57.6 Kbps - 10,000 ft. (3048m)
OFF	OFF	115.2 Kbps - 5,000 ft. (1524m)
OFF	ON	230.4 Kbps - 2,500 ft. (762m)
ON	ON	not used

on = closed
off = open

I/O Rack Number (without Complementary I/O

1771-ASB series C and series D)

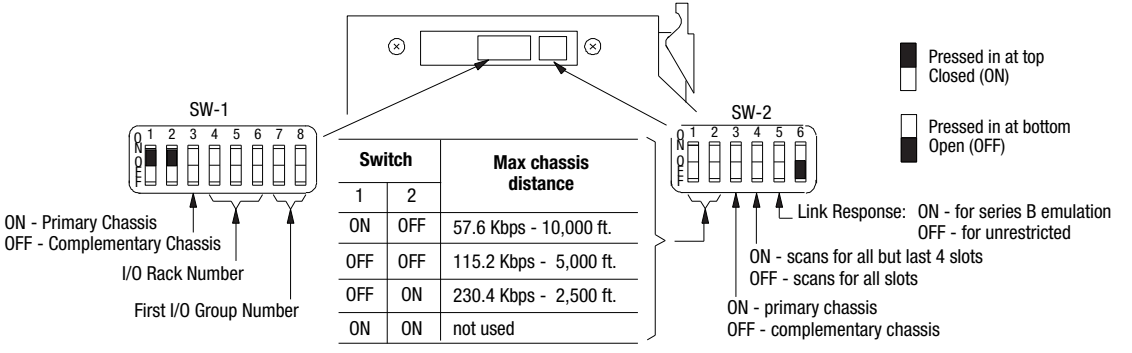
on = closed
off = open

Rack	1	2	3	4	5	6	Rack	1	2	3	4	5	6
01	on	on	on	on	on	off	15	on	on	off	off	on	off
02	on	on	on	on	off	on	16	on	on	off	off	off	on
03	on	on	on	on	off	off	17	on	on	off	off	off	off
04	on	on	on	off	on	on	20	on	off	on	on	on	on
05	on	on	on	off	on	off	21	on	off	on	on	on	off
06	on	on	on	off	off	on	22	on	off	on	on	off	on
07	on	on	on	off	off	off	23	on	off	on	on	off	off
10	on	on	off	on	on	on	24	on	off	on	off	on	on
11	on	on	off	on	on	off	25	on	off	on	off	on	off
12	on	on	off	on	off	on	26	on	off	on	off	off	on
13	on	on	off	on	off	off	27	on	off	on	off	off	off
14	on	on	off	off	on	on							

PLC-5/15, -5/20, -5/20E, -5/20C processors address racks 01-03
PLC-5/11 processor address rack 3 only
PLC-5/25, -5/30 processors address racks 01-07

PLC-5/40, -5/40E, -5/40L, -5/40C processors address racks 01-17
PLC-5/60, -5/60L, -580, -5/80E, -5/80C processors address racks 01-27

Switch Assemblies with Complementary I/O in a Remote I/O Adapter Module (1771-ASB series C and series D)



Switch		Max chassis distance
1	2	
ON	OFF	57.6 Kbps - 10,000 ft.
OFF	OFF	115.2 Kbps - 5,000 ft.
OFF	ON	230.4 Kbps - 2,500 ft.
ON	ON	not used

on = closed
off = open

I/O Rack Number	4	5	6
1	on	on	off
2	on	off	on
3	on	off	off
4	off	on	on
5	off	on	off
6	off	off	on
7	off	off	off

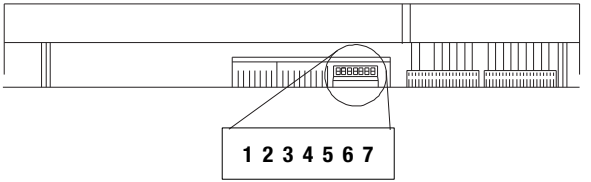
For First I/O Group Number	7	8
0	on	on
2	on	off
4	off	on
6	off	off

PLC-5/11 address rack 3 only PLC-5/15, -5/20, -5/20E, -5/20C address rack 01 - 03 only

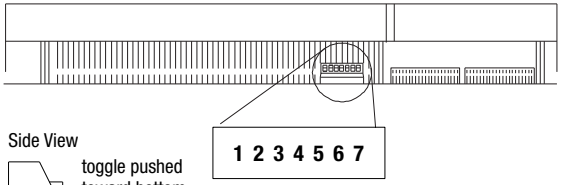
Important: Only seven racks can be complemented in a PLC-5 system.

Switch Settings – Enhanced, Ethernet, and ControlNet PLC-5 Processors, Series E or later
Switch Assembly 1

Side view of PLC-5/11, -5/20, -5/20E, -5/20C processors Switch Assembly SW1



Side view of PLC-5/30, -5/40, -5/40L, -5/40C, -5/60, -5/60L, -5/80, -5/40E, -5/80E, -5/60C processors Switch Assembly SW1



Side View

toggle pushed toward bottom on (closed)

toggle pushed toward top off (open)

Enhanced and ControlNet PLC-5 processors only

To select:	Set switch:	To:
DH+ station number	1 through 6	(see page 4-8)
DH+ baud rate	7	on (down) 57.6kbps off (up) 230.4kbps

Side View

toggle pushed down (D) on

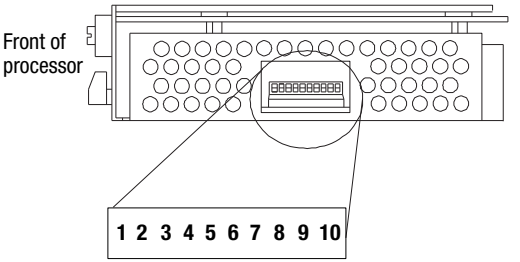
toggle pushed up (U) off

Station Number	1	2	3	4	5	6	Station Number	1	2	3	4	5	6	Station Number	1	2	3	4	5	6
0	D	D	D	D	D	D	26	D	U	U	D	U	D	53	U	U	D	U	D	U
1	U	D	D	D	D	D	27	U	U	U	D	U	D	54	D	D	U	U	D	U
2	D	U	D	D	D	D	30	D	D	D	U	U	D	55	U	D	U	U	D	U
3	U	U	D	D	D	D	31	U	D	D	U	U	D	56	D	U	U	U	D	U
4	D	D	U	D	D	D	32	D	U	D	U	U	D	57	U	U	U	U	D	U
5	U	D	U	D	D	D	33	U	U	D	U	U	D	60	D	D	D	D	U	U
6	D	U	U	D	D	D	34	D	D	U	U	U	D	61	U	D	D	D	U	U
7	U	U	U	D	D	D	35	U	D	U	U	U	D	62	D	U	D	D	U	U
10	D	D	D	U	D	D	36	D	U	U	U	U	D	63	U	U	D	D	U	U
11	U	D	D	U	D	D	37	U	U	U	U	U	D	64	D	D	U	D	U	U
12	D	U	D	U	D	D	40	D	D	D	D	D	U	65	U	D	U	D	U	U
13	U	U	D	U	D	D	41	U	D	D	D	D	U	66	D	U	U	D	U	U
14	D	D	U	U	D	D	42	D	U	D	D	D	U	67	U	U	U	D	U	U
15	U	D	U	U	D	D	43	U	U	D	D	D	U	70	D	D	D	U	U	U
16	D	U	U	U	D	D	44	D	D	U	D	D	U	71	U	D	D	U	U	U
17	U	U	U	U	D	D	45	U	D	U	D	D	U	72	D	U	D	U	U	U
20	D	D	D	D	U	D	46	D	U	U	D	D	U	73	U	U	D	U	U	U
21	U	D	D	D	U	D	47	U	U	U	D	D	U	74	D	D	U	U	U	U
22	D	U	D	D	U	D	50	D	D	D	U	D	U	75	U	D	U	U	U	U
23	U	U	D	D	U	D	51	U	D	D	U	D	U	76	D	U	U	U	U	U
24	D	D	U	D	U	D	52	D	U	D	U	D	U	77	U	U	U	U	U	U
25	U	D	U	D	U	D														

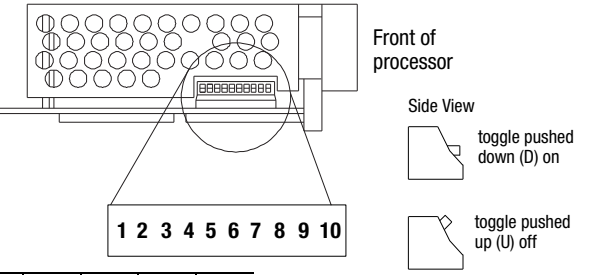
Switch Settings – Enhanced, Ethernet, and ControlNet PLC-5 Processors

Switch Assembly 2

Bottom view of PLC-5/11, -5/20, -5/20E, -5/20C15 processors
Switch Assembly SW2

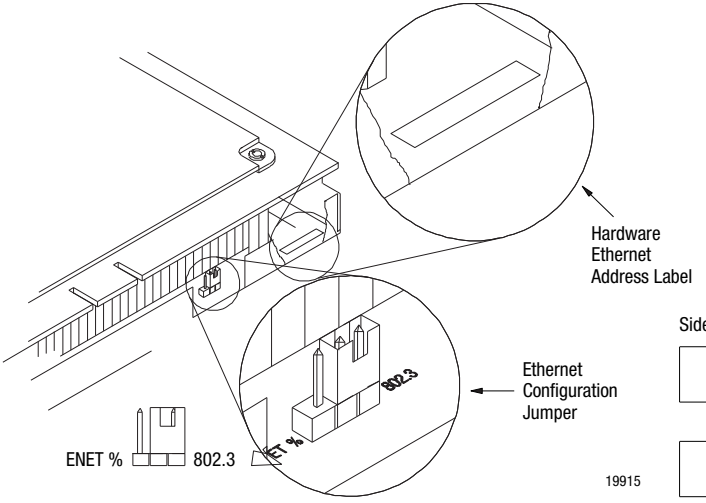


Bottom view of PLC-5/30, -5/40, -5/40L, -5/40C15, -5/60, -5/60L, -5/80, -5/40E, -5/80E, -5/80C15 processors
Switch Assembly SW2



To use this serial port configuration:	1	2	3	4	5	6	7	8	9	10
RS-232C	D	D	D	U	U	D	D	U	D	U
RS-422	U	U	D	U	U	U	U	U	D	U
RS-423	D	D	D	U	U	D	U	U	D	U

Ethernet Configuration
Jumper – PLC-5/20E, -5/40E, -5/80E



The Ethernet configuration jumper is located on the back of the processor. This jumper is factory set to 802.3, which is sufficient for most Ethernet networks. If your Ethernet network conforms to the DIX standard, set the jumper to ENET%.

The hardware Ethernet address label is located to the right of the Ethernet configuration jumper. This label shows the hardware Ethernet address assigned by Allen-Bradley.

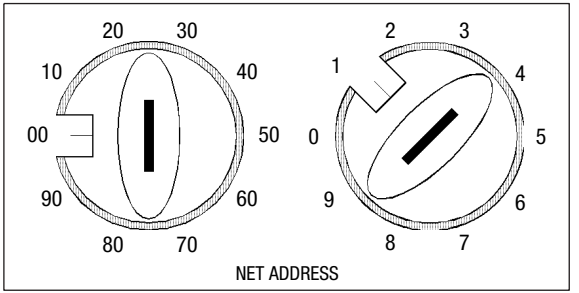
Side View

toggle pushed
down (D) on

toggle pushed
up (U) off

ControlNetwork Address

Select your processor's ControlNet network address by setting the two 10-digit rotary switches on the top of the processor.



Network address 01 is shown

▶ For optimum throughput, assign addresses to your ControlNet nodes in a sequential order starting with 01 for the controlling processor.

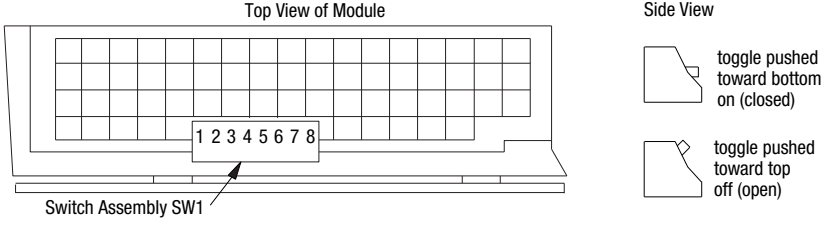
You can select from as many as 99 network addresses (from 01 to 99) for a processor on a ControlNet link. 00 is invalid.

☞

ControlNet PLC-5 processors only

Switch Settings – Classic PLC-5 Processors

Switch Assembly



To select:	Set switch:	To:
DH+ station number	1 through 6	(see page 5-12)
Switch 7 not used	7	off
scanner mode	8	off
adapter	8	on

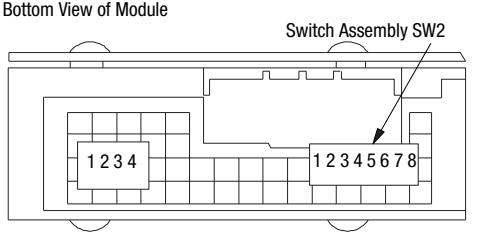
on = closed
off = open

Station Number	1	2	3	4	5	6	Station Number	1	2	3	4	5	6	Station Number	1	2	3	4	5	6
0	on	on	on	on	on	on	26	on	off	off	on	off	on	53	off	off	on	off	on	off
1	off	on	on	on	on	on	27	off	off	off	on	off	on	54	on	on	off	off	on	off
2	on	off	on	on	on	on	30	on	on	on	off	off	on	55	off	on	off	off	on	off
3	off	off	on	on	on	on	31	off	on	on	off	off	on	56	on	off	off	off	on	off
4	on	on	off	on	on	on	32	on	off	on	off	off	on	57	off	off	off	off	on	off
5	off	on	off	on	on	on	33	off	off	on	off	off	on	60	on	on	on	on	off	off
6	on	off	off	on	on	on	34	on	on	off	off	off	on	61	off	on	on	on	off	off
7	off	off	off	on	on	on	35	off	on	off	off	off	on	62	on	off	on	on	off	off
10	on	on	on	off	on	on	36	on	off	off	off	off	on	63	off	off	on	on	off	off
11	off	on	on	off	on	on	37	off	off	off	off	off	on	64	on	on	off	on	off	off
12	on	off	on	off	on	on	40	on	on	on	on	on	off	65	off	on	off	on	off	off
13	off	off	on	off	on	on	41	off	on	on	on	on	off	66	on	off	off	on	off	off
14	on	on	off	off	on	on	42	on	off	on	on	on	off	67	off	off	off	on	off	off
15	off	on	off	off	on	on	43	off	off	on	on	on	off	70	on	on	on	off	off	off
16	on	off	off	off	on	on	44	on	on	off	on	on	off	71	off	on	on	off	off	off
17	off	off	off	off	on	on	45	off	on	off	on	on	off	72	on	off	on	off	off	off
20	on	on	on	on	off	on	46	on	off	off	on	on	off	73	off	off	on	off	off	off
21	off	on	on	on	off	on	47	off	off	off	on	on	off	74	on	on	off	off	off	off
22	on	off	on	on	off	on	50	on	on	on	off	on	off	75	off	on	off	off	off	off
23	off	off	on	on	off	on	51	off	on	on	off	on	off	76	on	off	off	off	off	off
24	on	on	off	on	off	on	52	on	off	on	off	on	off	77	off	off	off	off	off	off
25	off	on	off	on	off	on														

Classic PLC-5
processors only

Switch Settings – Classic PLC-5 Processors – Switch Assembly 2

PLC-5 Processor as an Adapter in a PLC-5, Scanner Module or VME System

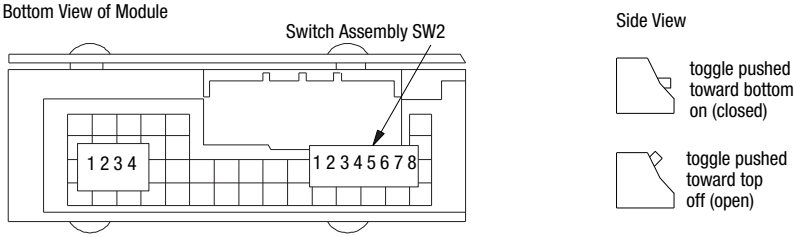


on = closed
off = open

If You Want:	Set switch:	To:
Switch 1 is always unused	1	off
The host processor to use **8 words** to communicate with the adapter PLC-5 processor	2	off
The host processor to use **4 words** to communicate with the adapter PLC-5 processor	2	on
The first I/O group to be 0	3	on
The first I/O group to be 4	3	off
To select the I/O rack number of the adapter PLC-5 processor	4 through 8	see table below

Switch Settings – Classic PLC-5 Processors – Switch Assembly 2

PLC-5 Processor as an Adapter in a PLC-5, Scanner Module or VME System



on = closed
off = open

If You Want:	Set switch:	To:
Switch 1 is always unused	1	off
The host processor to use **8 words** to communicate with the adapter PLC-5 processor	2	off
The host processor to use **4 words** to communicate with the adapter PLC-5 processor	2	on
The first I/O group to be 0	3	on
The first I/O group to be 4	3	off
To select the I/O rack number of the adapter PLC-5 processor	4 through 8	see table below

Remote I/O Rack Number
Classic PLC-5 Processor (except PLC-5/10) as an Adapter in a PLC-5,
Scanner Module, or VME System

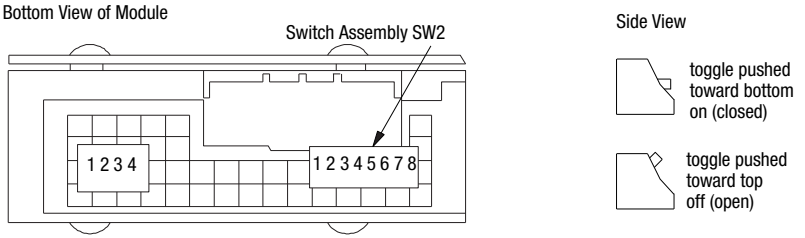
on = closed
off = open

Rack	4	5	6	7	8	Rack	4	5	6	7	8
01	on	on	on	on	off	15	on	off	off	on	off
02	on	on	on	off	on	16	on	off	off	off	on
03	on	on	on	off	off	17	on	off	off	off	off
04	on	on	off	on	on	20	off	on	on	on	on
05	on	on	off	on	off	21	off	on	on	on	off
06	on	on	off	off	on	22	off	on	on	off	on
07	on	on	off	off	off	23	off	on	on	off	off
10	on	off	on	on	on	24	off	on	off	on	on
11	on	off	on	on	off	25	off	on	off	on	off
12	on	off	on	off	on	26	off	on	off	off	on
13	on	off	on	off	off	27	off	on	off	off	off
14	on	off	off	on	on						

PLC-5/15, -5/20, -5/20E, -5/20C processors address racks 01-03PLC-5/40, -5/40L, -5/40E, -5/40C processors address racks 01-17
PLC-5/11 processor address rack 3 only (as remote I/O) PLC-5/60, -5/60L, -5/80, -5/80E, -5/80C processors address
PLC-5/25, -5/30 processors address racks 01-07racks 01-27

Switch Settings – Classic PLC-5 Processors
Switch Assembly 2

PLC-5 Processor as an Adapter in a PLC-2/20, -2/30 or Sub I/O Scanner Module System



If You Want:	Set switch:	To:
Switch 1 is always unused.	1	off
The host processor to use **8 words** to communicate with the adapter PLC-5	2	off
The host processor to use **4 words** to communicate with the adapter PLC-5	2	on
The first I/O group to be 0	3	on
The first I/O group to be 4	3	off
To select the I/O rack number of the adapter PLC-5 processor	4 through 8	see below

on = closed
off = open

Classic PLC-5 processors only

I/O Rack Number (PLC-5 Processor as an Adapter in a PLC-2/20, PLC-2/30, or Sub I/O Scanner Module System)

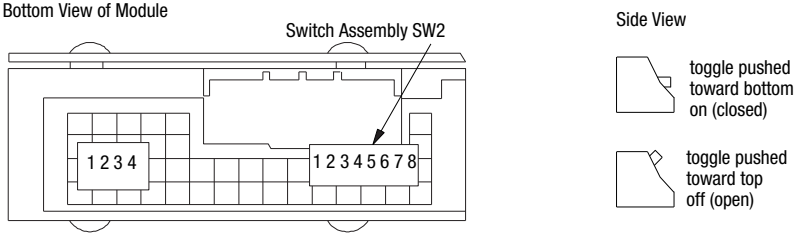
on = closed
off = open

Rack	4	5	6	7	8
01	on	on	on	on	on
02	on	on	on	on	off
03	on	on	on	off	on
04	on	on	on	off	off
05	on	on	off	on	on
06	on	on	off	on	off
07	on	on	off	off	on

Switch Settings – Classic PLC-5 Processors
Switch Assembly 2

PLC-5 Processor as an Adapter in a PLC-3 System or PLC-5/250 System

(8-word groups)



on = closed
off = open

If You Want:	Set switch:	To:
Switch 1 is always unused.	1	off
The host processor to use **8 words** to communicate with the adapter PLC-5 processor	2	off
To select the I/O rack number of the adapter PLC-5 processor	3 through 8	see below

Classic PLC-5 processors only

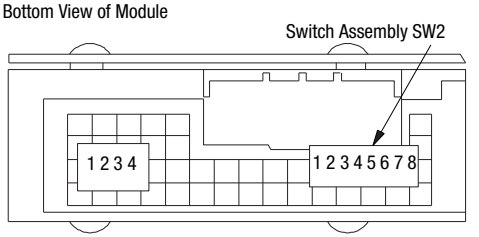
I/O Rack Number (PLC-5 Processor as an Adapter in a PLC-3 System or a PLC-5/250 System - 8-word groups)

Rack	3	4	5	6	7	8	Rack	3	4	5	6	7	8	Rack	3	4	5	6	7	8
0	on	on	on	on	on	on	26	on	off	on	off	off	on	53	off	on	off	on	off	off
1	on	on	on	on	on	off	27	on	off	on	off	off	off	54	off	on	off	off	on	on
2	on	on	on	on	off	on	30	on	off	off	on	on	on	55	off	on	off	off	on	off
3	on	on	on	on	off	off	31	on	off	off	on	on	off	56	off	on	off	off	off	on
4	on	on	on	off	on	on	32	on	off	off	on	off	on	57	off	on	off	off	off	off
5	on	on	on	off	on	off	33	on	off	off	on	off	off	60	off	off	on	on	on	on
6	n	on	on	off	off	on	34	on	off	off	off	on	on	61	off	off	on	on	on	off
7	on	on	on	off	off	off	35	on	off	off	off	on	off	62	off	off	on	on	off	on
10	on	on	off	on	on	on	36	on	off	off	off	off	on	63	off	off	on	on	off	off
11	on	on	off	on	on	off	37	on	off	off	off	off	off	64	off	off	on	off	on	on
12	on	on	off	on	off	on	40	off	on	on	on	on	on	65	off	off	on	off	on	off
13	on	on	off	on	off	off	41	off	on	on	on	on	off	66	off	off	on	off	off	on
14	on	on	off	off	on	on	42	off	on	on	on	off	on	67	off	off	on	off	off	off
15	on	on	off	off	on	off	43	off	on	on	on	off	off	70	off	off	off	on	on	on
16	on	on	off	off	off	on	44	off	on	on	off	on	on	71	off	off	off	on	on	off
17	on	on	off	off	off	off	45	off	on	on	off	on	off	72	off	off	off	on	off	on
20	on	off	on	on	on	on	46	off	on	on	off	off	on	73	off	off	off	on	off	off
21	on	off	on	on	on	off	47	off	on	on	off	off	off	74	off	off	off	off	on	on
22	on	off	on	on	off	on	50	off	on	off	on	on	on	75	off	off	off	off	on	off
23	on	off	on	on	off	off	51	off	on	off	on	on	off	76	off	off	off	off	off	on
24	on	off	on	off	on	on	52	off	on	off	on	off	on							
25	on	off	on	off	on	off														

on = closed
off = open

Switch Settings – Classic PLC-5 Processors
Switch Assembly 2

PLC-5 Processor as an Adapter in a PLC-3 System or a PLC-5/250 System (4-word groups)



on = closed
off = open

If You Want:	Set switch:	To:
Switch 1 is always unused.	1	off
The host processor to use **4 words** to communicate with the adapter PLC-5 processor	2	on
The first I/O group to be 0	3	on
The first I/O group to be 4	3	off
To select the I/O rack number of the adapter PLC-5 processor	4 through 8	see below

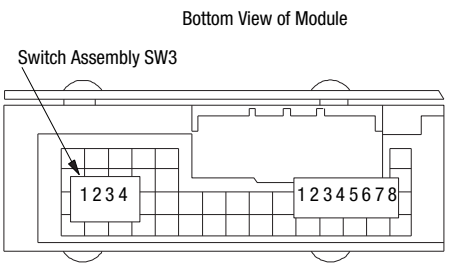
I/O Rack Number (PLC-5 Processor as an Adapter in a PLC-3 System or a PLC-5/250 System – 4-word groups)

on = closed
off = open

Rack	4	5	6	7	8	Rack	4	5	6	7	8
0	on	on	on	on	on	20	off	on	on	on	on
1	on	on	on	on	off	21	off	on	on	on	off
2	on	on	on	off	on	22	off	on	on	off	on
3	on	on	on	off	off	23	off	on	on	off	off
4	on	on	off	on	on	24	off	on	off	on	on
5	on	on	off	on	off	25	off	on	off	on	off
6	on	on	off	off	on	26	off	on	off	off	on
7	on	on	off	off	off	27	off	on	off	off	off
10	on	off	on	on	on	30	off	off	on	on	on
11	on	off	on	on	off	31	off	off	on	on	off
12	on	off	on	off	on	32	off	off	on	off	on
13	on	off	on	off	off	33	off	off	on	off	off
14	on	off	off	on	on	34	off	off	off	on	on
15	on	off	off	on	off	35	off	off	off	on	off
16	on	off	off	off	on	36	off	off	off	off	on
17	on	off	off	off	off	37	off	off	off	off	off

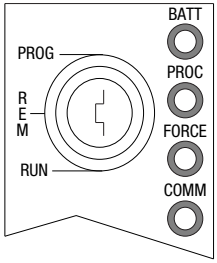
Switch Settings – Classic PLC-5 Processors

Switch Assembly



on = closed
off = open

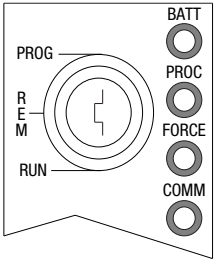
If the processor is:	Set switch:	To:
An end device on the remote I/O link	1	on
Not an end device on the remote I/O link	1	off
An end device on the Data Highway Plus link	2	on
Not an end device on the Data Highway Plus link	2	off
Switch 3 is unused	3	off
Switch 4 is unused	4	off



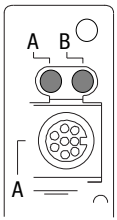
Indicator	Color	Description	Probable Cause	Recommended Action
PROC	green (steady)	processor in RUN mode and fully operational	normal operation	none
	green (blinking)	processor memory being transferred to EEPROM	normal operation	none
	red (blinking)	major fault	run-time error	Check major fault bit in status file (S:11) for error definition. Clear fault bit, correct problem, and return to RUN mode.
	red (steady)	major fault	• user RAM has checksum error • memory module error • internal diagnostics have failed	• Clear memory and reload program • Check backplane switch settings and/or insert correct memory module • Power down, reseat processor and power up. Then, clear memory and reload your program. Replace EEPROM with new program. Then, if necessary, replace the processor.

☞

troubleshooting – Enhanced, Ethernet, and ControlNet PLC-5 processor general problems continued...

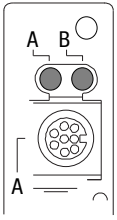


Indicator	Color	Description	Probable Cause	Recommended Action
PROC	off	processor in program load or TEST mode or is not receiving power		Check power supply and connections
	Alternating Red and Green	Processor in FLASH- memory programming mode	Processor FLASH memory checksum error	Contact your local A-B representative for a field firmware update
COMM	off	no transmission on channel 0	normal operation if port is not being used	none
	green (blinking)	transmission on channel 0	normal operation if port being used	none
FORCE	amber (steady)	SFC and/or I/O forces enabled	normal operation	none
	amber (blinking)	SFC and/or I/O forces present, but not enabled	normal operation	none
	off	SFC and/or I/O forces not present	normal operation	none
BATT	off	battery is good	normal operation	none
	red (steady)	battery low	battery low	Replace battery within 10 days (typical)

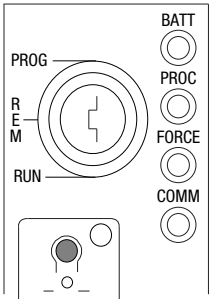


Indicator	Color	Channel Mode	Description	Probable Cause	Recommended Action
A or B	green (steady)	RIO scanner	active RIO link, all adapter modules are present and not faulted	normal operation	none
		RIO adapter	communicating with scanner	normal operation	none
		DH+	processor is transmitting or receiving on DH+ link	normal operation	none
	green (blinking rapidly or slowly)	RIO scanner	at least one adapter is faulted or failed	power off at remote rack cable broken	Restore power to the rack repair cable
		DH+	no other nodes on network		

troubleshooting – Enhanced, Ethernet, and ControlNet PLC-5 processor communication channel continued...



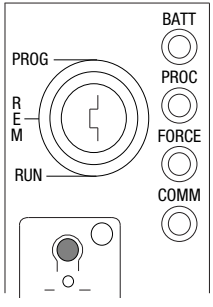
Indicator	Color	Channel Mode	Description	Probable Cause	Recommended Action
A or B (continued)	red (steady)	RIO scanner RIO adapter DH+	hardware fault	hardware error	Turn power off, then on. Check that the software configurations match the hardware set-up. Replace the processor.
	red (blinking rapidly or slowly)	RIO scanner	faulted adapters detected	• cable disconnected or broken • power off at remote racks	• Repair cable • Restore power to racks
		DH+	bad communication on DH+	duplicate node detected	Correct station address
	off	RIO scanner	channel off-line	channel is not being used	Place channel online if needed
		RIO adapter			
		DH+			



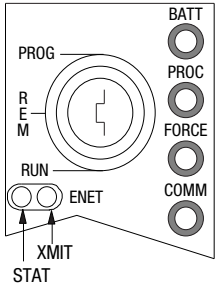
Indicator	Color	Channel Mode	Description	Probable Cause	Recommended Action
2	green (steady)	extended local I/O scanner	active extended local I/O link, all adapter modules are present and not faulted	normal operation	none
	green (blinking rapidly or slowly)	extended local I/O scanner	at least one adapter is faulted or failed	• power off at extended local I/O rack • communication fault • cable broken	• Restore power to the rack • Restart adapters using the processor restart lockout push-button • Repair cable

☞

troubleshooting – PLC-5/40L and PLC-5/60L processor (only) communication channel continued...



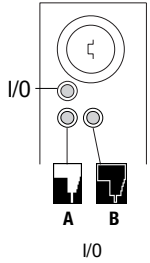
Indicator	Color	Channel Mode	Description	Probable Cause	Recommended Action
2 (continued)	red (steady)	extended local I/O scanner	hardware fault	hardware error	Turn power off, then on. Check that the software configurations match the hardware set-up. Replace the processor.
	red (blinking rapidly or slowly)	extended local I/O scanner	all adapters faulted	• cable disconnected or broken • terminator off • power off at remote racks	• Repair cable • Replace or repair terminator • Restore power to racks
	off	extended local I/O scanner	channel off-line	channel is not being used	Place channel online if needed



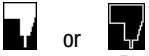
Indicator:	Color:	Description:	Probable Cause:	Recommended Action:
STAT	solid red	critical hardware fault	processor requires internal repair	Contact your local Allen-Bradley representative
	blinking red	hardware or software fault (detected and reported via a code)	fault code dependent	Contact Global Technical Support (GTS)
	off	Ethernet interface is functioning properly but it is not attached to an active Ethernet network	normal operation	Attach the processor to an active Ethernet network
	green	Ethernet port is functioning properly and has detected that it is connected to an active Ethernet network	normal operation	none

The PLC-5 Ethernet Transmit indicator (XMIT) lights (green) briefly when the Ethernet port is transmitting a packet (it does not indicate whether the Ethernet port is receiving a packet).

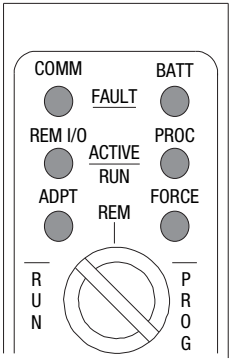
Troubleshooting – ControlNet Processors
Status Indicators

I/O Indicator	State	Description	Probable Cause(s)	Recommended Action(s)
 I/O	Off	ControlNet I/O not present or not operating	Normal operation if Channel 2 not being used	None
	Steady Green	All nodes configured in the ControlNet map table present and operating properly	Normal operation	None
	Flashing Green/Off	At least one node configured for the ControlNet network not present or not operating properly	Cable(s) or connector(s) broken or not connected	Repair or replace cable(s) or connector(s), and reconnect
			Destination module(s) bad or missing	Repair or replace module(s)
			Node(s) not on network	Connect node to network
	Flashing Red/Off	All nodes configured for ControlNet not present or not operating properly	Cable(s) or connector(s) broken or not connected	Repair or replace cable(s) or connector(s), and reconnect
			Nodes not on network	Connect nodes to network

Indicator	Color[1]	Probable Cause	Recommended Action
	Off	Internal diagnostics failed	1. Turn power off, make sure ControlNet address is not 00, reseat processor, then power up 2. Clear memory and reload your program 3. Replace EEPROM with new program 4. If still an error, replace the processor
		No power	Check power supply
	Steady Red	Faulted unit	Cycle power or reset unit
			If fault persists, contact your Rockwell Automation representative or distributor
	Flashing Green	Normal operation if processor is in FLASH memory program mode	No action required
	Flashing Red/Green	The processor's ControlNet address is above UMAX	Configure the ControlNet network so that UMAX is at least as high as the processor's ControlNet address.
			Set the processor's ControlNet address at or below UMAX.
	Alternating Red/Green	Self-test	No action required
	Alternating Red/Off	Incorrect node configuration	Check network address and other ControlNet configuration parameters

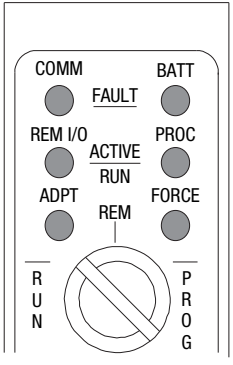
Indicator	Color[1]	Probable Cause	Recommended Action
 A or B	Off	Channel disabled	No action required
			Configure for ControlNet communication
	Steady Green	Normal operation	No action required
	Flashing Green/Off	Temporary errors	Make sure that the processor is connected to the ControlNet network with an Allen-Bradley tap.
			Check media for broken cables, loose connectors, missing terminators, etc.
	Flashing Red/Off	Media fault	Make sure that the processor is connected to the ControlNet network with an Allen-Bradley tap.
			Check media for broken cables, loose connectors, missing terminators, etc.
		No other nodes present on network	Add other nodes to the network
	Flashing Red/Green	Incorrect network configuration	Cycle power or reset unit
			If fault persists, contact your Rockwell Automation representative or distributor

[1] Definition of terms:
- **alternating**–the two indicators alternate between the two defined states at the same time (applies to both indicators 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
- **steady**–indicator is on continuously in the defined state

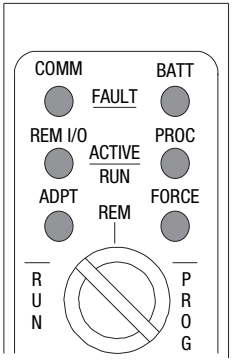


Indicator	Color	Description	Probable Cause	Recommended Action
PROC REM I/O COMM	all red (steady)		internal diagnostics have failed	Power down, reseat processor and power up. Then, clear memory and reload your program. Replace EEPROM with new program. Then, if necessary, replace the processor.
FORCE	amber (steady)	forces enabled	normal operation	none
	amber (blinking)	forces present, but not enabled	normal operation	none
	off	no forces present	normal operation	none
BATT	off	battery is good	normal operation	none
	red (steady)	battery low		Replace battery within 1-2 days (typical).
ADPT	green (steady)	processor is in adapter mode	normal operation	none
	off	processor is in scanner mode	normal operation	none

Troubleshooting – Classic PLC-5 Processor General Problems troubleshooting – Classic PLC-5 processors general problems continued...



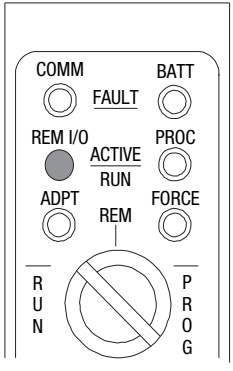
Indicator	Color	Description	Probable Cause	Recommended Action
PROC	green (steady)	processor in RUN mode and fully operational	normal operation	none
	green (blinking)	processor memory being transferred to EEPROM	normal operation	none
	red (blinking)	major fault	run-time error	Check major fault bit in status file (S:11) for error definition. Clear fault bit, correct problem, and return to RUN mode.
	red (steady)	major fault	• user RAM has checksum error • memory module error	• Clear memory and reload program • Check backplane switch settings and/or insert correct memory module
	off	processor in program load or TEST mode or is not receiving power		Check power supply and connections



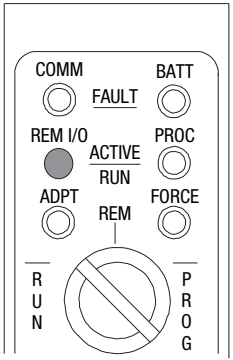
Indicator	Color	Description	Probable Cause	Recommended Action
PROC REM I/O COMM	all red (steady)		internal diagnostics have failed	Power down, reseat processor and power up. Then, clear memory and reload your program. Replace EEPROM with new program. Then, if necessary, replace the processor.
FORCE	amber (steady)	forces enabled	normal operation	none
	amber (blinking)	forces present, but not enabled	normal operation	none
	off	no forces present	normal operation	none
BATT	off	battery is good	normal operation	none
	red (steady)	battery low		Replace battery within 1-2 days (typical).
ADPT	green (steady)	processor is in adapter mode	normal operation	none
	off	processor is in scanner mode	normal operation	none

☞

Troubleshooting – Classic PLC-5 Processors (except PLC-5/10) in Adapter Mode

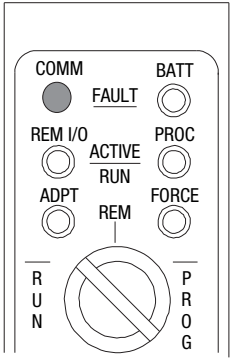


Indicator	Color	Description	Probable Cause	Recommended Action
REM I/O	green (steady)	active remote I/O link	normal operation	none
	green (blinking)	remote I/O active and host processor is in program load or TEST mode	normal operation	none
	red (steady)	no communication with host processor	duplicate station address selected	Correct station address
	green (sporadic)	bad communication with host processor		Check connections
	off	no communication with host processor		no action required

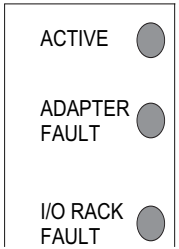


Indicator	Color	Description	Probable Cause	Recommended Action
REM I/O	green (steady)	active remote I/O link	normal operation	none
	red (steady)	remote I/O link fault	wiring, adapter module(s)	• Check all connections, check adapter module(s) • If you have 6200 Series Software, put the processor in PROG mode and do an auto configure for remote racks (see your 6200 Series Software documentation)
	green/red (blinking)	partial remote I/O link fault	one or more remote I/O chassis faulted	• Check status bits in I/O status file (element #7) to identify faulted chassis number; check wiring, adapter module(s), power supplies • If you have 6200 Series Software, put the processor in PROG mode and do an auto configure for remote racks (see your 6200 Series Software documentation)
	off	no remote I/O selected		none

Troubleshooting – Classic PLC-5 Processors (except PLC-5/10 and PLC-5/12) in Scanner Mode



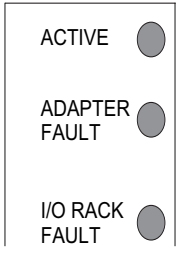
Indicator	Color	Description	Probable Cause	Recommended Action
COMM	green (blinking rapidly or slowly)	processor is transmitting or receiving on DH+ link	normal operation	none
	red (steady)	watchdog time-out	hardware error	Turn power off, then on. Check that the software configurations match the hardware set-up. Replace the processor.
	red (sporadic)	bad communication on DH+ link	duplicate station address selected	Correct station address
	off	• if directly connected to processor, no communication on DH+ link • if last processor on DH+ link, no communication on DH+ link		• no action required • Check DH+ wiring connections.



Indicators			Description	Probable Cause	Recommended Action
Active	Adapter Fault	I/O Rack			
On	Off	Off	normal indication; remote adapter is fully operational		
Off	On	Off		RAM memory fault watchdog time-out	Replace module
On	Blink	Off	module placement error	I/O module in incorrect slot	Place module in correct slot in chassis
Blink in unison		Off	incorrect starting I/O group number	error in starting I/O group number or I/O rack address	Check switch settings. Refer to table 3.B to verify acceptable beginning I/O group number; set switches correctly.
On	On	On	module not communicating	incorrect baud rate setting	Check switch settings
Off	On	On	module not communicating	scan switch set for “all but last 4 slots” in 1/4 rack	Reset scan switch setting

See page 5-20 for footnotes

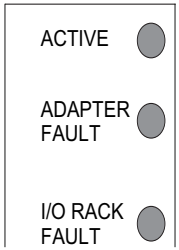
troubleshooting – remote I/O system, 1771-ASB series C and series D continued...



Indicators			Description	Probable Cause	Recommended Action
Active	Adapter Fault	I/O Rack			
Blink	Off	Off	remote adapter not actively controlling I/O (scanner to adapter communication link is normal) [4]	processor is in program or test mode scanner is holding adapter module in fault mode	Fault should be cleared by I/O scanner
LEDs sequence on/off from top to bottom			module not communicating	another remote I/O adapter with the same address is on the link	Correct the address
Blink alternately		Off	adapter module not actively controlling I/O [2] adapter module in processor restart lockout mode (adapter to scanner link is normal)	processor restart lockout switch on chassis backplane switch assembly on [1]	Depress reset button to clear lockout feature or cycle power; if after repeated attempts indicators are still blinking, check: • push-button not wired properly to field wiring arm • wiring arm not connected to adapter module • adapter module was reset by processor/scanner, then immediately faulted

See page 5-20 for footnotes

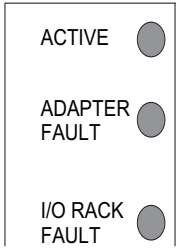
☞



Indicators			Description	Probable Cause	Recommended Action
Active	Adapter Fault	I/O Rack			
Off	Off	On	I/O chassis fault. [2] No communication on link.	Problem exists between: • adapter and module in chassis; the module will stay in fault mode until fault is corrected • shorted printed circuit board runs on backplane or I/O module	Cycle power to the chassis to clear a problem resulting from high noise [3] • Remove and replace all I/O modules one at a time • If the problem does not clear, something is wrong in chassis or I/O module
Blink	Off	On	Communication on link. Possible shorted backplane	• noise on backplane • shorted circuit board runs • faulty card in chassis	• Eliminate noise • Isolate noise • Add surge suppression • Replace chassis • Replace defective card in chassis
Blink	On	Off	module identification line fault	excessive noise on backplane	Verify power supply and chassis grounding

See page 5-20 for footnotes

troubleshooting – remote I/O system, 1771-ASB series C and series D continued...



Indicators			Description	Probable Cause	Recommended Action
Active	Adapter Fault	I/O Rack			
Off	Off	Off	module not communicating	• power supply fault • wiring from scanner to adapter module disrupted • scanner not configured properly • one faulted chassis within a rack group address causing scanner/distribution panel to fault all chassis in rack group address (when in disable search mode)	• Check power supply, cable connections, and make sure adapter module is fully seated in chassis • Correct cable and wiring defects • Refer to publication 1772-2.18 for scanner configuration • Check sequentially from the first module to the last module to pinpoint fault; correct any faults and proceed to the next chassis

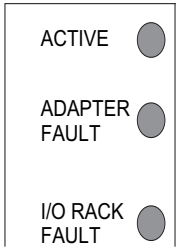
1 You must select the operating mode of the remote I/O adapter module as outlined in the publication furnished with the remote I/O scanner/distribution panel, remote I/O scanner-program interface module, or I/O scanner-message handling module. Pay close attention to the disable search mode in the 1772-SD, -SD2.

2 The I/O chassis is in faulted mode as selected by the last state switch on the chassis backplane.

3 Cycling power clears the block-transfer request queue. All pending block transfers are lost. Your program must repeat the request for block transfers from the chassis.

4 If a fault occurs and the processor is in the run mode but is actually operating in the dependent mode, the chassis fault response mode is selected by the last state switch on the chassis backplane.

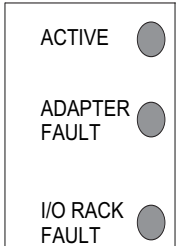
☞



Indicator	Response	Description	Probable Cause	Recommended Action
Active Adapter Fault I/O Rack Fault	On Off Off	normal indication; remote adapter is fully operational		
Active Adapter Fault I/O Rack Fault	On or off On On or off	remote adapter fault [2]	remote adapter not operating; it will stay in fault mode until fault is corrected	Cycle power to the chassis to clear the adapter fault.[3] Replace adapter if fault does not clear.
Active Adapter Fault I/O Rack Fault	On or off Off On	I/O chassis fault [2]	Problem exists between: • adapter and module in chassis; the module will stay in fault mode until fault is corrected • shorted printed circuit board runs on backplane or I/O module	Cycle power to the chassis to clear a problem resulting from high noise. [3] • Remove and replace all I/O modules one at a time • Replace adapter • If the problem does not clear, something is wrong in chassis or I/O module

See page 5-24 for footnotes

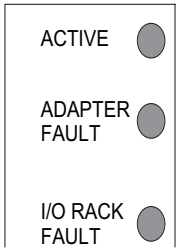
troubleshooting – remote I/O system, 1771-ASB series B continued...



Indicator	Response	Description	Probable Cause	Recommended Action
Active Adapter Fault I/O Rack Fault	Blinking Off Off	remote adapter not actively controlling I/O (scanner to adapter communication link is normal) [4]	processor is in program or test mode scanner is holding adapter module in fault mode	None Fault should be cleared by I/O scanner.
Active Adapter Fault I/O Rack Fault	Blinking alternately Off	adapter module not actively controlling I/O [2] adapter module in processor restart lockout mode (adapter to scanner link is normal)	processor restart lockout switch on chassis backplane switch assembly on [1]	Depress reset button to clear lockout feature or cycle power; if after repeated attempts indicators are still blinking, check: • push-button not wired properly to field wiring arm • wiring arm not connected to adapter module • adapter module was reset by processor/ scanner, then immediately faulted

See page 5-24 for footnotes

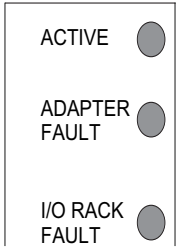
☞



Indicator (on I/O rack)	Response	Description	Probable Cause	Recommended Action
Active Adapter Fault I/O Rack Fault	Off Off Off	If remote I/O scanner/distribution panel (1772-SD, -SD2) is in disable search mode, then response is normal.[2]	• power supply fault • wiring from scanner to adapter module disrupted • scanner not configured properly • one faulted chassis within a rack group address causing scanner/distribution panel to fault all chassis in rack group address (when in disable search mode)	• Check power supply, cable connections, and make sure adapter module is fully seated in chassis • Correct cable and wiring defects • Refer to publication 1772-2.18 for scanner configuration • Check sequentially from the first module to the last module to pinpoint fault; correct any faults and proceed to the next chassis
Active Adapter Fault I/O Rack Fault	Blinking On On	module identification line fault	excessive noise on backplane	Verify power supply and chassis grounding

See page 5-24 for footnotes.

troubleshooting – remote I/O system, 1771-ASB series B continued...



Indicator (on I/O rack)	Response	Description	Probable Cause	Recommended Action
Active Adapter Fault I/O Rack Fault	On Blinking Off	module placement error in remote I/O chassis	incorrect placement of high-density modules	Verify addressing modes and switch settings
Active Adapter Fault I/O Rack Fault	Both flash in unison Off	incorrect starting I/O group number for chassis size	error in starting I/O group number or I/O rack address	Refer to processor manual to verify acceptable beginning I/O group number; set switches correctly

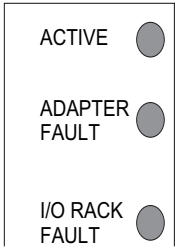
1 You must select the operating mode of the remote I/O adapter module as outlined in the publication furnished with the remote I/O scanner/distribution panel, remote I/O scanner-program interface module, or I/O scanner-message handling module. Pay close attention to the disable search mode in the 1772-SD and 1772-SD2.

2 The I/O chassis is in faulted mode as selected by the last state switch on the chassis backplane.

3 Cycling power clears the block-transfer request queue. All pending block transfers are lost. Your program must repeat the request for block transfers from the chassis.

4 If a fault occurs and the processor is in the run mode but is actually operating in the dependent mode, the chassis fault response mode is selected by the last state switch on the chassis backplane.

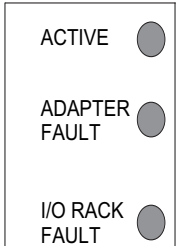
Troubleshooting – Extended Local I/O System, 1771-ALX



Indicator	Response	Description	Probable Cause	Recommended Action
Active Adapter Fault I/O Rack Fault	On Off Off	normal indication; adapter is fully operational		
Active Adapter Fault I/O Rack Fault	Off On Off	local adapter fault [2]	Local adapter not operating; it will stay in fault mode until fault is corrected	Cycle power to the chassis to clear the adapter fault.[3] Replace adapter if fault does not clear.
Active Adapter Fault I/O Rack Fault	Blinking Off On	I/O chassis fault [2]	Problem exists between: • adapter and module in chassis; the module will stay in fault mode until fault is corrected • shorted printed circuit board runs on backplane or I/O module	Cycle power to the chassis to clear a problem resulting from high noise.[3] • Remove and replace all I/O modules one at a time • Replace adapter • If the problem does not clear, check chassis or I/O module

See page 5-27 for footnotes

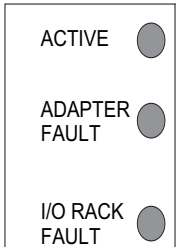
troubleshooting – extended local I/O system, 1771-ALX continued...



Indicator	Response	Description	Probable Cause	Recommended Action
Active Adapter Fault I/O Rack Fault	Blinking Off Off	outputs are reset	• processor is in program or test mode • local I/O Scanner is holding adapter module in fault mode	• none • Fault should be cleared by Local I/O scanner
Active Adapter Fault I/O Rack Fault	Blinking alternately Off	adapter module not actively controlling I/O [2] adapter module in processor restart lockout mode (adapter to scanner link is normal)	processor restart lockout switch on chassis backplane switch assembly on [1]	Depress chassis reset button to clear lockout feature or cycle power; if after repeated attempts indicators are still blinking, check that adapter module was reset by processor/scanner, then immediately faulted

See page 5-27 for footnotes

☞



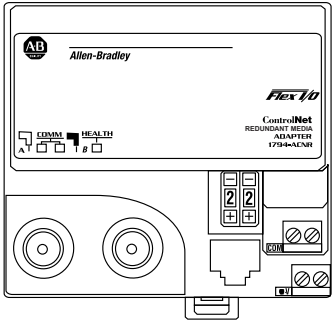
Indicator	Response	Description	Probable Cause	Recommended Action
Active Adapter Fault I/O Rack Fault	Off Off Off	no power or no communication.	power supply fault	Check power supply, cable connections, and make sure adapter module is fully seated in chassis
Active Adapter Fault I/O Rack Fault	On Blinking Off	module placement error in extended local I/O chassis	incorrect placement of high-density modules	Verify addressing modes and switch settings

1 The I/O chassis is in faulted mode as selected by the last state switch on the chassis backplane.

2 Cycling power clears the block-transfer request queue. All pending block transfers are lost. Your program must repeat the request for block transfers from the chassis.

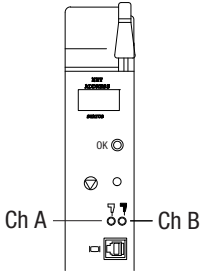
3 If a fault occurs and the processor is in the run mode but is actually operating in the dependent mode, the chassis fault response mode is selected by the last state switch on the chassis backplane.

Troubleshooting – 1794-ACN(R)15 FLEX I/O ControlNet Adapter Indicators



Indicators Comm A and B (simultaneously)	Indicator	Probable Cause
A and B	Off	No power, or reset
	Red	Adapter inoperative
	Flashing Red/Green	Adapter self-test
	Flashing Red/Off	Bad node configuration (duplicate address)
Indicators Comm A or B (individually)		
A or B	Off	Channel disabled
	Green	Channel operational
	Flashing Green/Off	Temporary network errors
	Flashing Red/Off	Cable fault, broken cable, redundancy warning
	Flashing Red/Green	Bad network configuration
STATUS Indicator		
STATUS	Off	No power
	Flashing Green	On-line but not connected
	Green	On-line, link okay, connected
	Flashing Red	I/O module removed, wrong I/O module inserted, or FLASH program update in progress
	Red	Critical - adapter failure

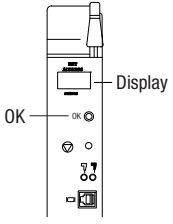
Troubleshooting – 1771-ACN(R)15 ControlNet Indicators



Indicators Ch A and B (simultaneously)	Cause	Action
Off	No power	Power up
Red	Faulted unit	Cycle power or reset unit
Flashing Red/Green	Self-test	None
Flashing Red/Off	Incorrect node configuration	Check network address and other ControlNet configuration parameters
Indicators Ch A or B (individually)		
Off	Channel disabled	Program network for redundant media if required
Green	Normal operation	None
Flashing Green/Off	Temporary errors	None, unit will self-correct
	Node is not configured to go on line	Make sure the configuration manager node is present and working*
Flashing Red/Off	Media fault	Check media for broken cable, loose connectors, missing terminators, etc.
	No other nodes present on network	Add other nodes to the network
Flashing Red/Green	Incorrect network configuration	Cycle power or reset unit. If fault persists, repair or replace adapter.

*The configuration manager mode is the node responsible for distributing the ControlNet configuration data to all nodes on the network.

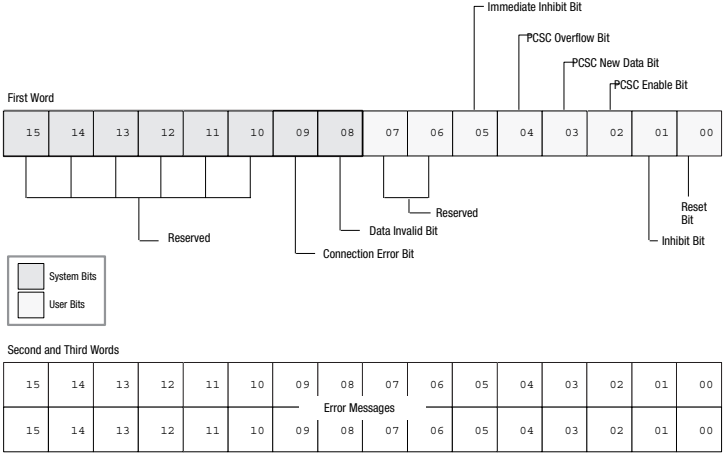
Troubleshooting – 1771-ACN(R)15 Adapter Status Indicators



OK Indicator		Display Mnemonic	Description	Probable Cause	Recommended Action
Green	Red				
Off	Off	None	Module not communicating	Power supply fault	Check power supply, cable connectors, and seat adapter firmly in chassis
				Defective adapter	Contact Rockwell Automation for service
		POST	Adapter is running Power On Self Test	None	None
Off	Blinking	POST RSET	Module failed Power On Self Test	RAM or FLASH test failed. Processor fault or watchdog time-out.	Push the reset button on the front of the module
		A#00 ERR	Illegal ControlNet address	Network address set to 00	Power down the adapter and change the network address switch settings
		MOD ERR	I/O module placement error	Incorrect I/O module density for addressing mode used	Place I/O module in correct slot in chassis
		RACK ERR	Illegal backplane switch settings	Illegal addressing mode selected	Power down the adapter and change the backplane switch settings
		PRL	Adapter in processor restart lockout mode (adapter to processor link is normal)	Processor restart lockout switch on chassis backplane in ON position	Depress reset button on module to clear lockout feature, or cycle power
		SHRT BP	Communication on line. Excessive noise on backplane or possible shorted backplane.	Defective I/O module or chassis backplane	Replace module or chassis
		DUPL NODE	Duplicate node address	Another adapter with the same ControlNet address is on the network	Power down the adapter and change the network address switches and cycle adapter power
		SW ERR	Switch error	Network address switches have been changed since module powerup	Set network address switches to correct address and cycle adapter power

OK Indicator		Display Mnemonic	Description	Probable Cause	Recommended Action
Green	Red				
Off	On	RPLC	Fatal Power On Self Test failure	RAM or FLASH test failed.Processor fault or watchdog time-out.	Contact Rockwell Automation for service
		None	Hardware fault	Defective hardware	
Blinking	Off	INIT	Requires ControlNet configuration	No communication with ControlNet Configuration Manager node	Verify Configuration Manager node is operating
		IDLE	Processor not actively controlling I/O	Adapter not mapped	Verify mapping of adapter in processor
		NET ERR	Network error	Cable error or no other nodes on network	Verify network cabling
On	Off	RUN	Normal indication - processor is in RUN mode	None	None
		PRGM	Normal indication - processor is in program or test mode	None	None
Blinking in unison		CODE UPDT	Firmware update mode	Adapter firmware is being updated via A-B Flash Update Utility	None
Blinking alternately		BOOT	Running boot code	Adapter has corrupted firmware	Update adapter firmware with A-B Flash Update Utility

The ControlNet status file is an integer data-table file that you specify and configure with the I/O map for scheduled-I/O usage. It contains status information about all of the ControlNet network's scheduled I/O connections. Each I/O map-table entry has a status-file offset field pointing to three status words associated with the connection.



The following table explains the bits in the first word of the ControlNet I/O status file:

Bit Number	Description	Use
00	Reset Bit	Set this bit to put the associated connection into PROGRAM mode, even if the processor is in Run mode. Clear this bit to set the mode of the associated connection according to the processor's mode. This bit has no effect for 1771 block transfer modules.
01	Inhibit Bit	Set this bit to perform an orderly shutdown of the associated connection. If the target node is a ControlNet adapter, the adapter will go into idle mode. The processor will not attempt to reopen the connection as long as this bit is set. The processor will also set the Data Invalid Bit and Connection Error Bit. Clear this bit to allow the processor to attempt to open the associated connection.
02	PCSC Enable Bit	Set this bit to enable Process Control Sample Complete for the associated I/O map entry. Clear this bit to disable Process Control Sample Complete for the associated I/O map entry.
03	PCSC New Data Bit	The processor sets this bit when the PCSC Enable Bit is set and new data arrives from the associated connection. Clear this bit when you are finished processing the current sample of data.
04	PCSC Overflow Bit	The processor sets this bit when the PCSC Enable Bit and the PCSC New Data Bits are set and new data arrives from the associated connection. This means that PCSC data is arriving faster than your ladder program is processing it. Clear this bit after you modify your ladder program to handle the incoming PCSC data.
05	Immediate Inhibit Bit	Set this bit to immediately stop communicating on the associated connection. This has the same effect as if you disconnected the target node from the ControlNet network. If the target node is a ControlNet adapter and the adapter is setup for Processor Restart Lockout, the adapter will go into Processor Restart Lockout mode. The processor will not attempt to reopen the connection as long as this bit is set. The processor will also set the Data Invalid Bit and Connection Error Bit. Clear this bit to allow the processor to attempt to open the associated connection.
08	Data Invalid Bit	The processor sets this bit when data is not received from the associated target node. The error code in second and third words of the ControlNet I/O status tells you why the data is invalid. Also, if either the Inhibit Bit or Immediate Inhibit Bit is set, the Data Invalid Bit will be set. The processor clears this bit when valid data is received from the associated target node. In your program, make sure that this bit is clear before you use the associated data.
09	Connection Error Bit	The processor sets this bit when the associated connection is not made to the target node. The error code in second and third words of the ControlNet I/O status tells you why the connection is not made. Also, if either the Inhibit Bit or Immediate Inhibit Bit is set, the Connection Invalid Bit will be set. The processor clears this bit when the associated connection is made to the target node.

The following table explains the second and third status words in the ControlNet I/O status file.

ControlNet I/O Connection Type	Bit 9 of First Word of I/O Status File Entry (Connection Error)	Second Word of I/O Status File Entry	Third Word of I/O Status File Entry
All	Set	0	Error code (see the “Error Messages” section)
Receive Data	Clear	0	0 = peer processor is in PROGRAM mode 1 = peer processor is in RUN mode
Send Data	Clear	0	Number of peer listeners
1747 Discrete	Clear	If bit *x* is clear, then the module in slot *x* is OK. If bit *x* is set, then the module in slot *x* is missing, bad, or is the wrong type.	
1747 Analog	Clear	If bit *x* is clear, then the module in slot *x* is OK. If bit *x* is set, then the module in slot *x* is missing, bad, or is the wrong type.	
1771 Discrete	Clear	0	0
1771 Analog Read	Clear	0	Error code from read
1771 Analog Write	Clear	Error code from write	0
1771 Analog Read/Write	Clear	Error code from write	Error code from read

ControlNet I/O Connection Type	Bit 9 of First Word of I/O Status File Entry (Connection Error)	Second Word of I/O Status File Entry	Third Word of I/O Status File Entry
1794 Discrete	Clear	0	If bit *x* is clear, then the module in slot *x* is OK. If bit *x* is set, then the module in slot *x* is missing, bad, or is the wrong type.
1794 Analog Read	Clear	0	If bit *x* is clear, then the module in slot *x* is OK. If bit *x* is set, then the module in slot *x* is missing, bad, or is the wrong type.
1794 Analog Write	Clear	0	0
1794 Analog Read/Write	Clear	0	If bit *x* is clear, then the module in slot *x* is OK. If bit *x* is set, then the module in slot *x* is missing, bad, or is the wrong type.

Error Messages

The following is a list of ControlNet error codes, messages, possible causes, and possible corrective actions:

Decimal Code	Hex. Code	Error Message	Explanation/Possible Cause(s)	Possible Corrective Action(s)
VARIOUS	VARIOUS	CONFIGURATION DATA CORRUPTED	The ControlNet configuration is corrupted.	Reenter the map entry that is failing.
				Reenter the ladder instruction that is failing.
1	0x0001	CONNECTION FAILED	The ControlNet cable from the originating node to the target node is broken or disconnected.	Fix and/or reconnect the ControlNet cable.
			The target node is not powered.	Supply power to the target node.
			The target's node number is greater than SMAX.	Reconfigure the ControlNet network so that the target's node number is less than or equal to SMAX.
5	0x0005	UNKNOWN DESTINATION ADDRESS	The slot addressed does not exist.	Use a rack with more slots.
				Correct the I/O map table.

Decimal Code	Hex. Code	Error Message	Explanation/Possible Cause(s)	Possible Corrective Action(s)
			The map table is corrupted.	Reenter the I/O map entry that is failing.
			The target node of the MSG instruction is not a processor or the target node of the CIO instruction is not the correct I/O adapter.	Edit the ladder program so that the correct target node is used.
				Replace the target node with the correct type of node.
12	0x000C	OBJECT IN WRONG STATE	The target Scheduled Peer Output map entry is inhibited.	Clear the inhibit and immediate inhibit bits for the target Scheduled Peer Output map entry.
14	0x000E	ATTRIBUTE CANNOT BE SET	A CIO instruction attempted to set an attribute that cannot be set at the destination module. For example, a CIO tried to send safe-state data to a Flex module that does not support safe-state data.	Insert a module that can have this attribute set into the correct slot.
				Edit the ladder program so that it does not attempt to set this attribute.
19	0x0013	NOT ENOUGH DATA	The transfer length is zero.	Increase the transfer length.
			The processor data table is too small to hold the data to be transferred.	Increase the size of the data table to accommodate the transfer length.
21	0x0015	TOO MUCH DATA	The transfer length is too large.	Decrease the transfer length.

Decimal Code	Hex. Code	Error Message	Explanation/Possible Cause(s)	Possible Corrective Action(s)
38	0x0026	INVALID DESTINATION ADDRESS SIZE	The map table is corrupted.	Reenter the I/O map entry that is failing.
			The target node of the MSG instruction is not a processor or the target node of the CIO instruction is not the correct I/O adapter.	Edit the ladder program so that the correct target node is used.
				Replace the target node with the correct type of node.
256	0x0100	CONNECTION IN USE	The connection at the target node is already in use.	No action is required. The connection can be re-established after the target node times out the old connection.
262	0x0106	CONNECTION USED BY OTHER NODE	The originating node attempted to use a connection that is already being used by another node.	Delete or inhibit any other node's connection so that the preferred node can establish the connection.
			A non-discrete connection is setup to a discrete module.	Replace the target module with the correct non-discrete module.
				Correct the I/O map table.
263	0x0107	CONNECTION NOT FOUND	The connection at the target node does not exist.	Make sure I/O map entries exist in the I/O map tables of both the originating and target nodes.
265	0x0109	INVALID CONNECTION SIZE	The originating node requested a connection size that the target node cannot accommodate.	Correct the connection size in the map table. If it is a listen-only connection, make sure that the connection size is not larger that the size of the controlling connection.
				Set the addressing mode switches of the 1771 rack dip correctly.
				Use a rack with the correct number of slots.
273	0x0111	INVALID RPI	The target node cannot produce the data at or faster than the requested packet interval (RPI) entered in the map table.	Increase the requested packet interval (RPI) entered in the map table.

Decimal Code	Hex. Code	Error Message	Explanation/Possible Cause(s)	Possible Corrective Action(s)
275	0x0113	OUT OF CONNECTIONS	The maximum number of connections to/from this node has been exceeded.	Reduce the number of I/O connections, MSG instructions, or CIO instructions to/from this node.
276	0x0114	PRODUCT CODE MISMATCH	The target node/module does not match the node/module entered in the map table.	Replace the target node/module with the correct node/module.
277	0x0115	PRODUCT TYPE MISMATCH		Correct the I/O map table.
278	0x0116	REVISION MISMATCH	The series/revision of the target node/module does not match the series/revision entered in the map table.	Replace the target node/module with the correct node/module.
				Correct the I/O map table.
279	0x0117	INVALID CONNECTION POINT	The PLC-5C is requesting data from a ControlLogix tag that does not exist.	Change the PLC-5C I/O map entry to use the correct tag.
				Change or add the tag to the ControlLogix processor.
			The PLC-5C does not support ControlNet hot backup. Refer to publication 1785-6.5.24 for more information.	Verify that the PLC-5C is a Series F PLC-5/40C or -5/80C.
				Verify that the 1785-CHBM Hot Backup module is properly installed.
			The target node does not support ControlNet Hot Backup.	Replace the target node with one that supports ControlNet Hot Backup.
280	0x0118	INVALID CONFIGURATION FORMAT	The target node/module does not match the node/module entered in the map table.	Replace the target node/module with the correct node/module.
				Verify that the target node/module is powered up.
				Correct the map table.

Decimal Code	Hex. Code	Error Message	Explanation/Possible Cause(s)	Possible Corrective Action(s)
281	0x0119	OWNER CONNECTION NOT OPEN	The originating node attempted to open a listen-only connection before the owner connection was opened.	Correct any connection errors associated with the owner connection.
			The CIO instruction failed because the 1771 discrete rack has no owner.	In the I/O map table, add a discrete connection for the 1771 I/O rack.
			The ControlNet cable from the controlling node to the target node is broken or disconnected.	Fix and/or reconnect the ControlNet cable.
			The controlling node is not powered.	Supply power to the controlling node.
			The target 1771 adapter is in Processor Restart Lockout.	Press the reset button on the target 1771 adapter.
				Cycle power to the target 1771 adapter.
282	0x011A	OUT OF APPLICATION CONNECTIONS	The maximum number of connections to/from this node has been exceeded.	• If this is an I/O connection, reduce the number of I/O connections. • If this is a MSG instruction, reduce the number of MSG instructions. • If this is a CIO instruction, reduce the number of CIO instructions.
515	0x0203	CONNECTION TIMED OUT	The ControlNet cable from the originating node to the target node is broken or disconnected.	Fix and/or reconnect the ControlNet cable.
			The target node is not powered.	Supply power to the target node.

Decimal Code	Hex. Code	Error Message	Explanation/Possible Cause(s)	Possible Corrective Action(s)
516	0x0204	UNCONNECTED REQUEST TIMED OUT	The ControlNet cable from the originating node to the target node is broken or disconnected.	Fix and/or reconnect the ControlNet cable.
			The target node is not powered.	Supply power to the target node.
			The originator's and/or the target's node number is greater than UMAX.	Reconfigure the ControlNet network so that the originator's and target's node numbers are less than or equal to UMAX.
			The target node is too busy to respond.	Reduce the number of unconnected requests to the target node.
769	0x0301	OUT OF BUFFER MEMORY	The maximum number of connections to/from this node has been exceeded.	• If this is an I/O connection, reduce the number of I/O connections. • If this is a MSG instruction, reduce the number of MSG instructions. • If this is a CIO instruction, reduce the number of CIO instructions.
770	0x0302	SCHEDULED BANDWIDTH NOT AVAILABLE	There are too many words scheduled for transmission.	Edit the I/O map table to reduce the number of scheduled words.
			The network update time (NUT) is too small.	Increase the network update time (NUT).
			The originator's and/or the target's node number is greater than SMAX.	Reconfigure the ControlNet network so that the originator's and target's node numbers are less than or equal to SMAX.

Decimal Code	Hex. Code	Error Message	Explanation/Possible Cause(s)	Possible Corrective Action(s)
772	0x0304	NO SCHEDULED CONFIGURATION	The ControlNet cable from the originating node to the keeper was broken or disconnected when the ControlNet network was configured.	Fix and/or reconnect the ControlNet cable and reconfigure the ControlNet network.
			The keeper was not powered when the ControlNet network was configured.	Supply power to the keeper and reconfigure the ControlNet network.
			The originating and/or target node is not properly configured to send scheduled data.	Edit the I/O map table of the originating and/or target nodes to send scheduled data.
773	0x0305	SCANNER SIGNATURE MISMATCH	The ControlNet cable from the originating node to the keeper was broken or disconnected when the ControlNet network was configured.	Fix and/or reconnect the ControlNet cable. Reconfigure the ControlNet network by enabling and accepting edits with RSNetWorx.
			The ControlNet processor was not configured on the current network.	Reconfigure the ControlNet network by enabling and accepting edits with RSNetWorx.
			The ControlNet network was formed by joining two existing ControlNet networks.	Reconfigure the new ControlNet network by enabling and accepting edits with RSNetWorx.
774	0x0306	KEEPER NOT AVAILABLE	The ControlNet cable from the originating node to the keeper is broken or disconnected.	Fix and/or reconnect the ControlNet cable.
			The keeper is not powered.	Supply power to at least one ControlNet processor.
			No keeper exists on the ControlNet network.	Add at least one ControlNet processor to the network. Reconfigure the ControlNet network by enabling and accepting edits with RSNetWorx.
789	0x0315	INVALID PATH SEGMENT TYPE	The map table is corrupted.	Reenter the I/O map entry that is failing.
			The target node of the CIO instruction is not the correct I/O adapter.	Edit the ladder program so that the correct target node is used.
				Replace the target node with the correct adapter.

Decimal Code	Hex. Code	Error Message	Explanation/Possible Cause(s)	Possible Corrective Action(s)
791	0x0317	INVALID SCHEDULE DATA	The ControlNet cable from the originating node to the programming terminal was broken or disconnected when the ControlNet network was configured.	Fix and/or reconnect the ControlNet cable and reconfigure the ControlNet network.
			The originating node was not powered when the ControlNet network was configured.	Supply power to the originating node and reconfigure the ControlNet network.
797	0x31D	INVALID TARGET TAG	The PLC-5C is requesting data from a ControlLogix tag that is not configured as a producer.	Change the PLC-5C I/O map entry to use the correct tag.
				Reconfigure the tag in the ControlLogix processor to be a producer.
798	0x31E	TAG IS ALREADY PRODUCED THE MAXIMUM NUMBER OF TIMES	The PLC-5C is requesting data from a ControlLogix tag that is already being produced the maximum number of times.	In the ControlLogix processor, increase the number of times this tag can produce data.
65522	0xFFF2	CONFIGURATION FROM MAP ENTRY FAILED	The ControlNet cable from the originating node to the target node is broken or disconnected.	Fix and/or reconnect the ControlNet cable.
			The target node is not powered.	Supply power to the target node.
			The target slot is empty.	Insert the proper module in the correct slot of the target node.
			The target slot contains the wrong module type.	
			An incorrect module or slot was entered in the map table.	Edit the I/O map table to show the correct module type and slot.
65523	0xFFF3	CONTROLNET TRANSFER QUEUE FULL	The immediate CIO instruction could not be executed because the queue is full.	Edit the ladder program so that the number of active 1771 READ/WRITE CIO instructions is equal to or less than the maximum of 32.

Decimal Code	Hex. Code	Error Message	Explanation/Possible Cause(s)	Possible Corrective Action(s)
65527	0xFFF7	MODULE TIMED OUT	The target slot is empty.	Insert the proper module in the correct slot of the target node.
			The target slot contains the wrong module type.	
			An incorrect module or slot was entered in the map table.	Edit the I/O map table to show the correct module type and slot.
65529	0xFFF9	COMMUNICATION ERROR CAUSED LOSS OF DATA	A communication error between the adapter and the module caused the transfer to be aborted.	Make sure that the module is properly seated in the correct slot of the target node.
				Make sure that the adapter's power supply is providing the proper voltage.
			The target slot contains the wrong module type.	Insert the proper module in the correct slot of the target node.
			An incorrect module or slot was entered in the I/O map table.	Edit the I/O map table to show the correct module type and slot.

Decimal Code	Hex. Code	Error Message	Explanation/Possible Cause(s)	Possible Corrective Action(s)
65530	0xFFFA	MODULE DECLARED INVALID LENGTH	A communication error between the adapter and the module caused the transfer to be aborted.	Make sure that the module is properly seated in the correct slot of the target node.
				Make sure that the adapter's power supply is providing the proper voltage.
			The target slot contains the wrong module type.	Insert the proper module in the correct slot of the target node.
			An incorrect module or slot was entered in the map table.	Edit the I/O map table to show the correct module type and slot.
65531	0xFFFB	INVALID READ DATA	A communication error between the adapter and the module caused the transfer to be aborted.	Make sure that the module is properly seated in the correct slot of the target node.
				Make sure that the adapter's power supply is providing the proper voltage.
			The target slot contains the wrong module type.	Insert the proper module in the correct slot of the target node.
			An incorrect module or slot was entered in the map table.	Edit the I/O map table to show the correct module type and slot.
65532	0xFFFC	INVALID WRITE DATA	A communication error between the adapter and the module caused the transfer to be aborted.	Make sure that the module is properly seated in the correct slot of the target node.
				Make sure that the adapter's power supply is providing the proper voltage.
			The target slot contains the wrong module type.	Insert the proper module in the correct slot of the target node.
			An incorrect module or slot was entered in the map table.	Edit the I/O map table to show the correct module type and slot.
65533	0xFFFD	DATA TABLE TOO SMALL	The processor data table is too small to hold the data to be transferred.	Increase the size of the data table to accommodate the transfer length.

Fault Codes

Fault routines execute when a PLC-5 processor encounters a run-time error (major fault) during program execution.

A fault routine processes the major fault bit found in S:11 and determines the course of program execution based on the fault bit present. Fault routines provide a means to either:

- systematically shut down a process or control operation
- log and clear the fault and continue normal operation

For more information about fault routines, see Enhanced and Ethernet PLC-5 Programmable Controllers User Manual, publication 1785-6.5.12.

Clearing Faults

When a major fault occurs, you need to clear faults before your process can continue.

ATTENTION: Clearing a major fault does **not** correct the **cause** of the fault. Be sure to examine the fault bit and correct the cause of the fault before clearing it.

For example, if a major fault is encountered that causes bit S:11/2 to be set, which indicates a *programming error*, **do not** use a routine to clear the fault until you correct your program.

Additional Major Fault Codes

The processor stores fault codes in word 12 of the processor status file (S:12). The following table lists new major fault codes specific to the ControlNet processor.

This fault code:	Indicates this fault:	Take this corrective action:
200	ControlNet scheduled output data missed. The processor is unable to transmit the scheduled data it is configured to transmit.	Check your network for missing terminators or other sources of electrical noise (see the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1)
201	ControlNet input data missed. The processor is unable to process incoming data from the network	Check your network for missing terminators or other sources of electrical noise (see the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1).
202	This error code is reserved.	Contact your local Rockwell Automation representative if you get this message.
203	This error code is reserved.	Contact your local Rockwell Automation representative if you get this message.
204	Too many output connections per NUI.	Make scheduled outputs with short Requested Packet Intervals longer and reaccept edits for the ControlNet configuration.

This fault code:	Indicates this fault:	Take this corrective action:
205	ControlNet configuration exceeds processor bandwidth. **IMPORTANT: Scheduled connections will be closed. You must cycle power, save with RSNetWorx, or download the program to reopen the connections.** Because the configuration software is unable to accurately predict all the resources that the processor will require to execute your ControlNet configuration software (based on the relative loading on the processor), this fault code is used if the processor determines that your configuration (typically when you accept Channel 2 edits) exceeds the processor's available bandwidth. Typical causes of this error code include: • receiving data from the ControlNet network faster than the ControlNet PLC-5 processor can parse it • performing I/O updates too frequently • performing immediate ControlNet I/O ladder instructions too frequently.	• Reduce the number of ControlNet I/O map table entries. Possible ways to do this include: - using a discrete rack connection instead of multiple discrete module connections - combining multiple I/O racks into a single I/O rack - putting peer-to-peer data in contiguous blocks in the data table so that less send and receive scheduled messages are required • Increase your Network Update Time and/or increase the Requested Packet Intervals for scheduled data transfers in your I/O map table. • Increase your ladder program scan by either adding more logic or by increasing the Communications Time SLice (S:77). • Reduce the number or frequency of immediate ControlNet I/O ladder instructions that are performed.
206	This error code is reserved.	Contact your local Rockwell Automation representative if you get this message.
207	This error code is reserved.	Contact your local Rockwell Automation representative if you get this message.
208	Too many pending ControlNet I/O connections.	Delete one or more I/O map table entries and reaccept edits for the ControlNet configuration.

ControlNet Diagnostics File Layout

When you specify a Control Diagnostic File in RSNetWorx for the ControlNet network, the PLC-520C, -5/40C or -5/80CC processor copies the 40 words of diagnostic counters into the specified integer file.

Twenty-three additional diagnostic counters are available in the ControlNet diagnostic file. To access these counters, you must first use RSLogix5 to increase the size of the ControlNet diagnostic integer file to 63 words.

The layout of the ControlNet diagnostic file is described in the following table. The processor updates this file once every second.

Field Names	File Offset[1] (word;bits)	Field Names	File Offset[1] (word;bits)
Buffer Errors	0;15-00	Slot Overloads	11;15-08
Last 8 Nodes from which bad packets were received	1-4;	Aborted Frames Received	12;07-00
Good Frames Transmitted (center significant byte)	5;07-00	Non-Concurrences	12;15-08
Good Frames Transmitted (least significant byte)	5;15-08	Frames with Duplicate Node Address Received	13;07-00
Good Frames Received (least significant byte)	6;07-00	Lonely Occurrences	13;15-08
Good Frames Transmitted (most significant byte)	6;15-08	Collisions	14;07-00
Good Frames Received (most significant byte)	7;07-00	Noise Hits	14;15-08
Good Frames Received (center significant byte)	7;15-08	Moderators from non-lowmen	15;07-00
Channel A Errors	8;07-00	Node Address of current Moderator	15;15-08
Bad Received Frames	8;15-08	Cannot Hear Moderator Occurrences (i.e., Lonely)	16;07-00
Aborted Frames Transmitted	9;07-00	Network Parameter Mismatch Occurrences	16;15-08
Channel B Errors	9;15-08	Reserved	17;07-00
NUI Overloads	10;07-00	SM Commands Received from the wire	17;15-08
Highwaters/Out-of-Steps	10;15-08	Reserved	18;07-00
Blockages	11;07-00	Reserved	18;15-08

Field Names	File Offset[1] (word;bits)	Field Names	File Offset[1] (word;bits)
Fault Register -- Pre Reset	19;07-00	Maximum number of simultaneously active MSG instructions (always less than or equal to 32)	44
Reserved	19;15-08	Accumulated number of MSG connection time-outs	45
Reserved	20;07-00	Current number of active 1771 CIO instructions (always less than or equal to 32)	46
Fault Register -- Post Reset	20;15-08	Maximum number of simultaneously active 1771 CIO instructions (always less than or equal to 32)	47
Dirty bits	21;7-0	Accumulated number of 1771 CIO connection time-outs	48
SMAC version number	21;15-8	Current number of active 1794 and CIP CIO instructions (always less than or equal to 8)	49
Interface mode	22;7-0	Maximum number of simultaneously active 1794 and CIP CIO instructions (always less than or equal to 8)	50
Toggle bits	22;15-8	Accumulated number of 1794 and CIP CIO connection time-outs	51
Channel status (see following table)	23;7-0	Current number of open target Message Router connections (always less than or equal to 32)	52
Media bits (see following table)	23;15-8	Maximum number of simultaneously open target Message Router connections (always less than or equal to 32)	53
Reserved	24-39	Accumulated number of target Message Router connection time-outs	54
Current number of open scheduled connections (always less than or equal to the number in Word 41)	40	Current number of used unconnected clients (always less than or equal to 8)	55
Current number of configured scheduled connections	41	Maximum number of simultaneously used unconnected clients (always less than or equal to 8)	56
Accumulated number of scheduled connection time-outs	42	Accumulated number of unconnected client time-outs	57
Current number of active MSG instructions (always less than or equal to 32)	43	Current number of used unconnected servers (always less than or equal to 20)	58

Field Names	File Offset[1] (word;bits)	Field Names	File Offset[1] (word;bits)
Maximum number of simultaneously used unconnected servers (always less than or equal to 20)	59	Accumulated number of dropped unconnected requests	61
Accumulated number of unconnected server time-outs	60	Accumulated number of JITT overruns	62

[1]The file offset in the user-specified ControlNet diagnostics file. For example, if you specified N12, then the Buffer Errors would be located in N12:0, bits 15 - 00.

The following table describes each bit in word 23 (Channel status and Media bits) of the diagnostic file.

Bit(s):	Description:	Values:
2 - 0	channel A LED state	000 = off 001 = green 010 = flashing green/off 011 = flashing red/off 100 = flashing red/green 101 = railroading red/off 110 = railroading red/green 111 = red
5 - 3	channel B LED state	
6	redundancy warning	0 = normal 1 = non-selected channel is unusable
7	active channel	0 = channel B active 1 = channel A active
8	repeater mode	0 = device set for normal mode 1 = device set for repeater mode
9	channel A media mode	0 = configured for Coaxial 1 = configured for fiber
10	channel B media mode	0 = configured for Coaxial 1 = configured for fiber
15 - 11	reserved	

Rockwell *Automation*

Rockwell Automation helps its customers receive a superior return on their investment by bringing together leading brands in industrial automation, creating a broad spectrum of easy-to-integrate products. These are supported by local technical resources available worldwide, a global network of system solutions providers, and the advanced technology resources of Rockwell.

Worldwide representation.

Argentina • Australia • Austria • Bahrain • Belgium • Bolivia • Brazil • Bulgaria • Canada • Chile • China, People's Republic of • Colombia • Costa Rica • Croatia • Cyprus Czech Republic • Denmark • Dominican Republic • Ecuador • Egypt • El Salvador • Finland • France • Germany • Ghana • Greece • Guatemala • Honduras • Hong Kong Hungary • Iceland • India • Indonesia • Iran • Ireland • Israel • Italy • Jamaica • Japan • Jordan • Korea • Kuwait • Lebanon • Macau • Malaysia • Malta • Mexico Morocco • The Netherlands • New Zealand • Nigeria • Norway • Oman • Pakistan • Panama • Peru • Philippines • Poland • Portugal • Puerto Rico • Qatar • Romania • Russia Saudi Arabia • Singapore • Slovakia • Slovenia • South Africa, Republic of • Spain • Sweden • Switzerland • Taiwan • Thailand • Trinidad • Tunisia • Turkey • United Arab Emirates United Kingdom • United States • Uruguay • Venezuela

Rockwell Automation Headquarters, 1201 South Second Street, Milwaukee, WI 53204 USA, Tel: (1) 414 382-2000, Fax: (1) 414 382-4444
Rockwell Automation European Headquarters SA/NV, avenue Herrmann Debrouxlaan, 46, 1160 Brussels, Belgium, Tel: (32) 2 663 06 00, Fax: (32) 2 663 06 40
Rockwell Automation Asia Pacific Headquarters, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 1785-7.1 - May 1999
Supersedes Publication 1785-7.1 - August 1996
PN 955135-35