ControlNet PLC-5 Programmable Controllers - Phase 1.25

(Cat. No. 1785-L20C, -L40C, -L80C)

Series E, Revision A.1

Introduction

Use these release notes with the following PLC-5® processors:

Processor	Series	Revision	6200 Software Release
PLC-5/20C™ PLC-5/40C™ PLC-5/80C™	E	A.1	5.32.04 or later

Publication 1785-RN525A-EN-P - May 2002

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of these products 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. In no event will Rockwell Automation be responsible or liable for indirect or consequential damage resulting from the use or application of these products.

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

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

Throughout this publication, notes may be used to make you aware of safety considerations. The following annotations and their accompanying statements help you to identify a potential hazard, avoid a potential hazard, and recognize the consequences of a potential hazard:

WARNING

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

ATTENTION

Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

IMPORTANT

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

New Features

This firmware revision includes support for the following features:

- proportional, integral, derivative instruction enhancements
- Ethernet® Interface module support
- PID derivative smoothing filter disable option

Proportional, Integral, Derivative Instruction Enhancements

Series E ControlNet™ PLC-5 processors provide the following enhancements to the Proportional, Integral, Derivative (PID) instruction:

- Zero Crossing Deadband disable option
- Bias Back Calculation disable option
- Processor fault error code 35 changed to minor fault

Using the Zero Crossing Deadband Disable Option

If you are using A.1.5 programming software revision 8.0, you can access the No Zero Crossing bit with the "ZCD:" identifier.

Prior to the series E release, ControlNet PLC-5 processors introduced a Zero Crossing Deadband option. The deadband is a range around the process setpoint that you define. If you enabled this option, after the process variable approached and then crossed the setpoint value, the control variable did not change its value until the process variable moved out of the deadband range.

By disabling the Zero Crossing option, the control variable will not change its value as long as the process variable is within the deadband range; the process variable does not have to reach or cross the setpoint value for this feature to take effect.

By disabling the Zero Crossing option, you let deadband take effect without the process variable crossing the setpoint. This may be useful if your application involves running high inertia processes that slowly move a high mass that is difficult to stop. To disable this option, configure the PID control block using your programming software. The default setting for the Zero Crossing Deadband option is enabled.

If you are using A.1.5 programming software revision 8.0, you can access the No Bias Calculation bit with the "BCD:" identifier.

Using the Bias Back Calculation Disable Option

Prior to the series E release of ControlNet PLC-5 processors, the PID instruction operated as follows. In Manual mode, the integral accumulator was "back calculated" from the manual output value. This method of calculation prevented a bump in the control variable output when you switched the mode to automatic.

If the integral gain was zero, then there was no integral accumulator to back calculate; the only value left was the bias. When you switched the mode from manual to automatic, the bias value would be set to prevent a bump in the control variable output.

When you disable the Bias Back Calculation and the PID is in manual mode with an integral gain of 0, then the PID instruction will not perform the back calculation into the bias. To disable the Bias Back Calculation option, configure the PID control block using your programming software.

IMPORTANT If you use this option, you may permit a bump to occur in the control variable when switching from manual to automatic mode. The default setting for the Bias Back Calculation option is enabled.

Interpreting Fault Error Code 35

The series E release of the ControlNet processors changes processor fault error code 35 "`bad PID delta time entered`" from a major fault to a minor fault. This change prevents the processor from switching to Program mode if you create PID instructions online while in Run mode with a loop update time equal to zero. The minor fault is an arithmetic minor fault with the arithmetic overflow bit set.

Ethernet Interface Module Support

The PLC-5 Ethernet Interface module (1785-ENET) is a single-slot coprocessor module that attaches to the side of a ControlNet PLC-5 processor to provide Ethernet connectivity for the attached processor. This support is available for all ControlNet processors.

Please note the following:

- Be aware that if you save a physical image of a series D/B or later processor, you cannot perform a physical restore of the program to a series D/A or earlier processor.

  If you use logical saves and restores, this limitation does not apply to you. Programming software packages such as 6200 and AI5 default to logical saves and restores.

- Be aware that if the Ethernet Interface module faults, the PLC-5 processor declares major fault code 95, indicating that the Ethernet Interface module reported a fault. Major fault 95 is a recoverable fault which allows the PLC-5 processor to continue operating even though the Ethernet Interface module is no longer functioning. The Ethernet Interface module requires a power cycle to begin functioning after reporting a major fault of 95.

PID Derivative Smoothing Filter Disable Option

You can now set bit 5 in word 0 of the PID control block to disable the derivative smoothing filter in the derivative's calculation. Set or reset this bit by using your programming software's PID configuration screen for the PD control block. Do not set this bit in ladder logic.

Using this Release

Understanding I/O Buffer Pool Resources

When you accept the ControlNet configuration edits, the processor dynamically allocates buffers for each of its scheduled data transfers on the ControlNet network out of a pool of 8352 bytes. The formulas given in the following table describe how much memory is required to support each transfer of a given type.

Type of scheduled data transfer:	Buffer allocation formula:
scheduled peer output	56 + (output words * 4)
scheduled peer input	56
1794 discrete and non-discrete output	52 + ((discrete output words + analog output words) * 4)
1771 discrete output	56 + (output words * 4
1771 non-discrete output	56 + (output words * 4)

If you enter a configuration that requires more than the 8352 total bytes that are available, the processor will display a major fault as mentioned in the “Dealing with Faults with Large Configurations” section on page 8 (i.e., the processor RUN/FAULT status indicator is solid red).

If this occurs:

1. Cycle power.
2. Reconfigure your processor.

TIP

See the “Dealing with Faults with Large Configurations” section on page 8 for additional suggestions to minimize the effects of this potential limitation.

Resetting the SFC Startover Bit

TIP

Perform frequent saves as you build your configuration so you do not have to retype everything.

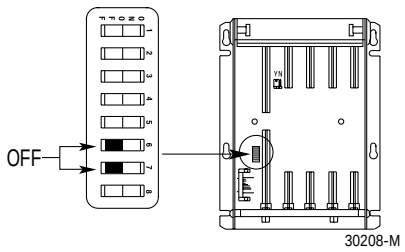
If the SFC startover bit is set in the processor configuration file, continuous CIOs may time out if you cycle power in RUN mode. If this happens, the CIO error bit is set.

To reset the error bit, the CIO instruction rung condition must go from FALSE to TRUE.

Cycling Power to Your Processor if You Are Using a EEPROM and Have a Battery in Your Processor

When you cycle power to the processor, it could potentially display a major fault with the processor RUN/FAULT status indicator solid red if:

- you have backplane switches 6 and 7 (EEPROM transfer) set to OFF, and



- you have a battery in the processor

To correct this fault, cycle power again to the processor, and the processor will reload from the memory cartridge.

Examining 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 the 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.

When the cursor:	The status text that appears corresponds to:	Clear these faults by:
is not on the major fault status word	the most significant fault	For fault codes 200 - 207 (see below): resetting individual bits. 1. Position the cursor on the bit associated with the fault (fault bit set to 1). 2. Type 0, and press [Enter]. If you have more than one major fault and you reset a bit, the status text displays the next major fault message. clearing the major fault by using your programming software This resets all major faults. When you clear major faults the processor also clears the fault code, program file, and rung number fields.
is on a major fault word bit, and that bit is set	the bit that the cursor is on If no bits are set, the message area is blank.	

Additional Major Fault Codes

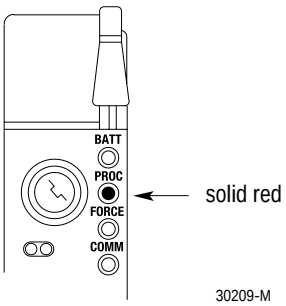
The processor stores fault codes in word 12 of the processor status file. The following table lists new major fault codes specific to the ControlNet processor.

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).

This fault code:	Indicates this fault:	Take this corrective action:
203	More data is scheduled than ControlNet bandwidth is available. This fault may be caused on a non-node 1 processor by changing the ControlNet configuration on node 1 if the non-node 1 processor is using scheduled peer-to-peer communication.	After changing your ControlNet configuration on node 1, do this: 1. Use your programming software to reaccept the ControlNet configuration on each non-node 1 processor that uses scheduled peer-to-peer communication. 2. Clear the processor fault.
204	ControlNet configuration is too complex for the processor. It is possible to create a ControlNet configuration that will cause the processor to fault when you download it to the processor or accept edits during on-line programming. This is caused if you have connections with a wide range of Expected Network Packet Times.	1. Verify that your configuration does not have large gaps in the Expected Network Packet Times of the various scheduled outputs present in your system. 2. Make scheduled outputs with slow expected packet times faster and reaccept edits for the ControlNet configuration. This will be addressed in a later release of the ControlNet processor.
205	ControlNet configuration exceeds processor bandwidth. 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.	Increase your Network Update Time and/or change the Expected Network Packet Time for scheduled data transfers in your configuration to provide more time for the processor to complete all of its tasks. This will be addressed in a later release of the ControlNet processor.
206	This error code is reserved.	Contact your local Allen-Bradley representative if you get this message.
207	This error code is reserved.	Contact your local Allen-Bradley representative if you get this message.

User Fault Routine

The ControlNet processor executes the fault routine for ControlNet major fault codes (200-207). You can decide whether or not to fault the processor when the processor detects a ControlNet major fault. Refer to publication 1785-6.5.12 for information on how to prepare and use fault routines.



Dealing with Faults with Large Configurations

In some instances, typically larger configurations, when the processor attempts to configure the network (either after a processor download or after a channel 2 configuration edit), the processor may determine that the ControlNet configuration exceeds the processor bandwidth. It will then display a major fault with the processor RUN/FAULT status indicator solid red. This can occur prior to a 205 fault code being generated. If this occurs:

1. Cycle power.
2. Reconfigure your processor.

TIP

To minimize the effects of this potential configuration limitation, consider the following suggestions:

- Enter your ControlNet configuration off line. This will create a reference point to work from prior to tuning your configuration on line.
- Enter your ControlNet configuration (off line or on line) by using a Network Update Time (NUT) and Expected Network Packet Times that are larger than you need and by saving your work prior to tuning your configuration on line.

After creating a base ControlNet configuration in your online processor, adjust your Network Update Time and/or Expected Network Packet Times to the desired values for a couple of nodes at a time. Continue to save your work often while making adjustments.

Continuous Mode Using MSG or CIO Instructions

If you use continuous mode MSG or CIO instructions, do not toggle the rung condition unless the instruction is stopped. Once enabled, the continuous mode will only stop under the following conditions:

- if an error is detected
- if you reset the CO bit
- if you set the TO status bit

You can change the CO and TO bits through the MSG or CT block configuration screen or by ladder logic. To start continuous mode, the CO bit must be set prior to the MSG or CIO instruction being enabled - with EN bit going true.

Using WINtelligent LINX 5.0 on a ControlNet Network

WINtelligent LIN™ 5.0 now includes ControlNet drivers that let WINtelligent LINX-compatible applications access ControlNet processors. WINtelligent LINX Gateway lets you bridge messages between ControlNet and any other WINtelligent LINX driver, e.g., DH+™, DH485, and Ethernet. If you are using WINtelligent LINX version 5.0 or later on a ControlNet network, you must also have a 1784-KTC, -KTCX series B, revision A or series A, revision B.

Replacing the Battery

This section replaces the “Replacing the Battery” section in chapter 1 of the ControlNet PLC-5 Programmable Controllers User Manual, publication 1785-6.5.14.

Replace the lithium battery every year or when the BATT status indicator is red. For estimated battery lifetimes, see the table below:

Worst-Case Battery-Life Estimates				
Processor	Temperature	Power Off 100%	Power Off 50%	Battery Duration(1)
PLC-5/20C	60°C	173 days	346 days	70 hours
	25°C	1.69 years	3.38 years	14.5 days
PLC-5/40C	60°C	92.5 days	185 days	38 hours
	25°C	1.25 years	2.5 years	10.8 days
PLC-5/80C	60°C	80 days	160 days	33 hours
	25°C	1.18 years	2.36 years	10 days

(1) The battery status indicator (BATT) warns you when the battery is low. These durations are based on the battery supplying the only power to the processor—power to the chassis is off—once the status indicator first lights.

If the LED on the front of the processor indicates BATT, it means that the battery must be replaced. You must use an exact replacement battery (cat. no. 1770-XYC).

ATTENTION

Lithium battery requirements:

- do not short, recharge, heat above 85° C, disassemble or expose contents to water
- use only the 1770-XYC battery in the processor. DO NOT use any other type or size of battery.

IMPORTANT

In non-hazardous environments, it may be possible to replace the battery while the processor is powered so that your programs are maintained in memory. You may lose your programs if you remove the battery when power is removed.

WARNING

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

- For safety information on the handling of lithium batteries, including handling and disposal of leaking batteries, refer to *Guidelines for Handling Lithium Batteries*, publication AG-5.4
- Store batteries in a cool, dry environment. We recommend 25° C with 40% or 60% relative humidity. You may store batteries up to 30 days between -45° - 85° C, such as during transportation. To avoid possible leakage, do not store batteries above 60° C for more than 30 days.

Processor Specifications

This information replaces Appendix A of the ControlNet PLC-5 Programmable Controllers User Manual, publication 1785-6.5.14.

Backplane Current	1785-5/20C: 2.7A @ 5Vdc 1785-5/40C, -5/80C: 3.3A @ 5Vdc
Heat Dissipation	1785-5/20C: 54 BTU/hour 1785-5/40C15, -5/80C: 59 BTU/hour
Adjacent Slot Power Dissipation	10W maximum
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0-60°C (32–140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bc, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5–95% non condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 1g @10–500Hz, 0.012 inches peak-to-peak displacement
Shock	IEC60068-2-27:1987, Test Ea (Unpackaged shock, ES#002) Operating - 30g peak acceleration for 11 ±1 ms duration Non-operating - 50g peak acceleration for 11 ±1 ms duration
Emissions	CISPR 11: Group 1, Class A (with appropriate enclosure)
ESD Immunity	IEC 61000-4-2: 4kV contact discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80% AM from 30MHz to 1000Mhz
EFT/B Immunity	IEC 61000-4-4: ±2kV at 5kHz on communications ports
Surge Transient Immunity	IEC 61000-4-5: ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 30MHz

Specifications continued on next page

Specifications (continued)

Enclosure Type Rating	None (open style)	
Time-of-Day Clock/Calendar[1]	Maximum Variations at 60° C: ± 5 min per month Typical Variations at 20° C: ± 20 s per month Timing Accuracy: 1 program scan	
Battery	Allen-Bradley 1770-XYC	
Memory Modules[3]	• 1785-ME16 • 1785-ME32 • 1785-ME64 • 1785-M100	
Compatible I/O Modules	Bulletin 1771 I/O, 1794 I/O, 1746 I/O, and 1791 I/O including 8-, 16-, 32-pt, and intelligent modules	
Hardware Addressing	2-slot • Any mix of 8-pt modules • 16-pt modules must be I/O pairs • No 32-pt modules 1-slot • Any mix of 8- or 16-pt modules • 32-pt modules must be I/O pairs 1/2-slot—Any mix of 8-,16-, or 32-pt modules	
Communication Types and Connectors and Cables	• Serial - using serial port connector (25-pin D-sub with screw locks) and cable (Belden 8243 or equivalent) • DH+ - using Phoenix contact connector (MSTB 2.5/3-ST) and cable (1771-CD) • DH using 1785-KA - using Phoenix Contact connector (MSTB 2.5/3-ST) and cable (1771-CD) • Remote I/O - using Phoenix contact connector (MSTB 2.5/3-ST) and cable (1771-CD) • ControlNet - using ControlNet taps (1786-TPYS, 1786-TPS, 1786-TPR, 1786-TPYR) • Programmng port - using Data Highway programming terminal cable (1784-CP)	Wire Category 2[2]
Location	1771-A1B, -A2B, A3B, -A3B1, -A4B chassis; left-most slot	
Weight	PLC-5/20C: 3 lbs, 3 oz (1.45 kg) PLC-5/40C: 3 lbs, 2 oz (1.42 kg) PLC-5/80C: 3 lbs, 2 oz (1.42 kg)	
Keying	• Between 40 and 42 • Between 54 and 56	
Certifications[3] **(when product is marked)**	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations CE European Union 89/336/EEC EMC Directive, compliant with: EN 50081-2; Industrial Emissions EN 50082-2; Industrial Immunity European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers C-Tick Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions	

1 The clock/calendar will update appropriately each year.

2 For more information, refer to publication 1770-4.1, *Industrial Automation Wiring and Grounding Guidelines*.

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

Specifications continued on next page

Specifications (continued)

		PLC-5/20C	PLC-5/40C	PLC-5/80C
Maximum User Memory Words		16K	48K[1]	100K[2]
Maximum Total I/O	**Any Mix**	512	2048	3072
	Complimentary	512 in and 512 out	2048 in and 2048 out	3072 in and 3072 out
Program Scan Time		0.5 ms per K word (bit logic) 2 ms per K word (typical)		
ControlNet I/O[3]	**Transmission Rate**	5M bit/s		
	Network Update Time (NUT)	2-100 ms (user selectable)		
	Number of ControlNet Ports	1 (redundant)		
	Maximum Number of Nodes per Link without a Repeater	48—with 250 m (approx. 820 ft) cable length		
	Maximum Number of Nodes per Link with Repeaters	107		
	Maximum Link Cable Length without a Repeater	1,000 m (approximately 3,280 ft)—with 2 nodes 500 m (approximately 1,640 ft)—with 32 nodes 250 m (approximately 820 ft)—with 48 nodes		
	Maximum Number of I/O Map Entries	64	64	64
	Maximum DIF/DOF Size	1000 words	1000 words	1000 words
	Maximum Link Cable Length with Repeaters	6,000 m (approximately 19,680 ft)—with 2 nodes 3,000 m (approximately 9,840 ft)—typical		
Remote I/O and DH+	**Transmission Rate**	57.6K bit/s 115.2K bit/s 230.4K bit/s		
	I/O Scan Time (Typical)	10 ms per rack @ 57.6K bit/s 7 ms per rack @ 115.2K bit/s 3 ms per rack @ 230K bit/s		
	Maximum Number of Remote I/O Racks	3	15	23
	Maximum Number of Remote I/O Devices	12	60	92
	Number of Ports Configurable for DH+ or Remote I/O (Adapter or Scanner)	1	2	2
	Number of Dedicated DH+ Ports	1	0	0
Number of Serial Ports		1		
Number of Coprocessor Ports		1		
Maximum Number of MCPs		16		

1 The PLC-5/40C processor has a limit of 32K words per data-table file.

2 The PLC-5/80C processor has a limit of 56K words per program file and 32 K words per data table file. The PLC-5/80C processor has 64K words of total data table space.

3 For more information, see the ControlNet Cable System Planning and Installation Manual, publication 1786-6.2.1.

Known Anomalies

1. This release does not support the Extended Data Table Forcing or Process Control Sample Complete features of the current Series E processors.

2. When adding or replacing a processor at node 1 of an existing network, the ControlNet network cable must be attached before power is applied to the processor. Failure to do this may fault the processor at node 1 when the network cable is attached.

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