SIEMENS

SIMATIC 505

Differential Analog Input Module (PPX:505–2555)

User Manual

Order Number: PPX:505–8130–1
Manual Assembly Number: 2806134–0001
Original Edition

⚠ DANGER

DANGER indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.

DANGER is limited to the most extreme situations.

⚠ WARNING

WARNING indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury, and/or property damage.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury, and/or damage to property.

CAUTION is also used for property-damage-only accidents.

MANUAL PUBLICATION HISTORY

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Preface

About This Manual

This user manual provides installation and operation instructions for the PPX:505-2555 Sixteen Channel Differential Analog Input Module for Series 505™ programmable controllers. This manual assumes you are familiar with the operation of Series 505 controllers (as described in the manuals listed below, under "Related Manuals").

Module Compatibility

This module is compatible with all of the SIMATIC® controllers except the 525. The 525 controller does not support the high-density WX16 mode required for operation. Refer to the appropriate user documentation for specific information on the Series 505 controllers and I/O modules.

Modes of Operation

This module can operate in either of the following modes:

- Standard mode: sixteen analog input channels, with several configuration options. This mode is described in Chapters 1 and 2.
- Advanced mode: high-density advanced functions, processed in the module. This mode is described in Chapter 3.

Organization

This manual is organized as follows:

- Chapter 1 provides a description of the module.
- Chapter 2 covers configuration, installation, and wiring.
- Chapter 3 covers advanced function programming.
- Appendix A is a guide to troubleshooting.
- Appendix B is a table of specifications.
- Appendix C is a log sheet for your configuration jumper settings.
- Appendix D is an I/O register quick reference chart.
- Appendix E is a set of V-memory configuration tables.
- Appendix F is an addressing worksheet.

Related Manuals

Additional manuals that have relevant information include the following:

- *SIMATIC 545/555/575 System Manual* (PPX:505–8201–x).
- *SIMATIC 545/555/575 Programming Reference User Manual* (PPX:505–8204–x).
- *SIMATIC 505 TISOFT2™ User Manual* (PPX:TS505–8101–x).

Refer to material in these manuals as necessary for additional information about programming and operating your 545/555/575 system.

Agency Standards

Series 505 products have been developed with consideration of the draft standard of the International Electrotechnical Commission Committee proposed standard (IEC–65A/WG6) for programmable controllers (released as IEC 1131–2, Programmable Controllers, Part 2: Equipment Requirements and Tests, First Edition, 1992–09). Contact Siemens Energy & Automation, Inc., for information about regulatory agency approvals that have been obtained on Series 505 units.

Agency Approvals

Agency approvals are the following:

- UL-listed (industrial control equipment)
- CUL (Canadian UL)
- FM (Class I, Div. 2, Group A, B, C, D Hazardous Locations)

European Community (CE) Approval

Generally, products listed in this manual comply with the essential requirements of European Community EMC Directive, number 89/336/EEC, and carry the CE label. See the declaration of conformity included with each CPU for a listing of specific products and compliance details.

Technical Assistance

For technical assistance, contact your Siemens Energy & Automation, Inc., distributor or sales office. If you need assistance in contacting your sales agent or distributor in the United States, call 1–800–964–4114.

Chapter 1

Description

1.1 Front Panel Description

The Sixteen Channel Analog Input Module (PPX:505-2555) is a member of the Series 505 analog family of Input/Output (I/O) modules for Series 505 controllers. The PPX:505-2555 is designed to translate an analog input signal into an equivalent digital word which is then sent to the controller.

Figure 1-1 shows the front panel of the Sixteen Channel Analog Input Module.

Active LED

The active LED is illuminated when the module is functioning normally. If the Active LED is not lit, refer to Appendix A for troubleshooting.

Input Connector for Channels 1 – 16

This connector provides wiring terminals for channels 1–16.

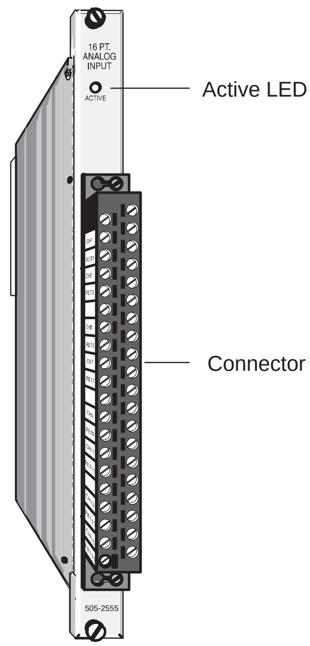


Figure 1-1 PPX:505-2555 Front Panel Description

1.2 Operating Modes

Asynchronous Operation

The module operates asynchronously with respect to the controller (a scan of the controller and input sampling of the module do not occur at the same time). Instead, the module translates all analog inputs in one module update (approximately 6 milliseconds) and stores the translated words in buffer memory. The controller retrieves the stored words from the module buffer memory at the start of the I/O scan.

Immediate I/O

The PPX:505-2555 Differential Analog Input Module is fully compatible with the Immediate Input function in the 545 and 555 controllers.

Unipolar or Bipolar Mode

The module may be configured to accept either unipolar or bipolar input signals. Selection of unipolar or bipolar mode is made using one internal jumper per channel (see Section 2.3).

Voltage or Current Mode

Each of the module's sixteen channels may be configured to receive either voltage or current analog input signals. For unipolar input signals, the range is 0 to 5 VDC, 0 to 10 VDC or 0 to +20 mA. For bipolar input signals, the signal range is –5 to +5 VDC, –10 to +10 VDC or –20 to +20 mA. Selection of voltage or current mode and voltage range are made via internal jumpers (see Section 2.3).

1.3 Digital Word Map

Overview

A unipolar analog input signal is translated into a 14-bit digital word. A bipolar input signal is translated into a 13-bit digital word plus 1-bit for the polarity sign. Since the controller requires a 16-bit input word, the 14-bit value from the converter is placed into a 16-bit word for transmittal to the controller.

Unipolar Presentation

As shown in Figure 1-2, of the two bits not used for the digital word, one is used to show the sign of the word, one is used to note values which are "overrange/underrange."

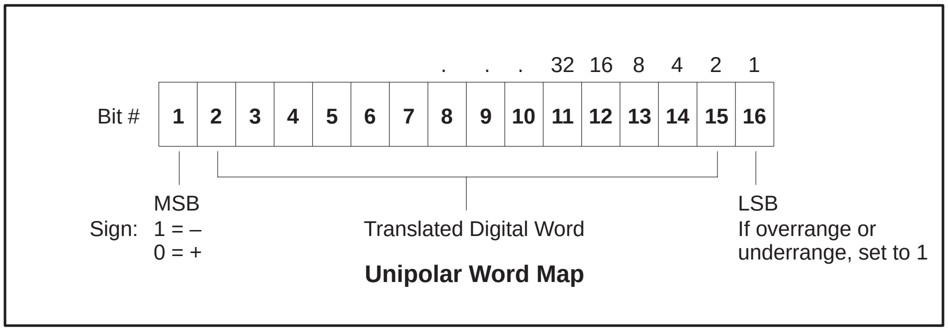


Figure 1-2 Word Input to the PLC from the Module (Unipolar)

Bipolar Presentation

As shown in Figure 1-3, of the three bits not used for the digital word, one is used to show the sign of the word, one is used to note values which are "overrange," and the remaining bit is not used and set to zero.

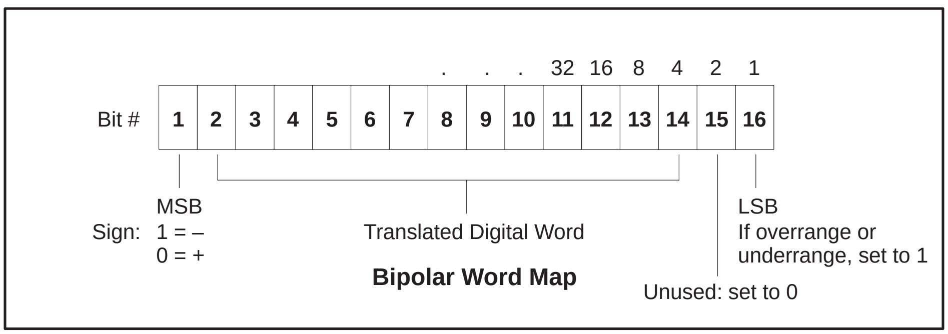


Figure 1-3 Word Input to the PLC from the Module (Bipolar)

NOTE: In the bipolar map, bit 15 is unused. There will, however, be cases where bit 15 will not be zero as indicated. Bipolar mode consists of 13 bits plus a sign bit. When this data is transformed to a 16-bit word space to the controller, some codes will result that will include bit 15.

1.4 Analog to Digital Conversion

Unipolar Mode Conversion

The following equations may be used to calculate the digital word which will result from a particular voltage or current input in the unipolar input mode:

$$\text{0 to 5 V Input Range Mode, Digital Word (WX)} = \frac{+\textit{Input voltage (V) x 32000}}{\textit{5 volts}}$$

$$\text{0 to 10 V Input Range Mode, Digital Word (WX)} = \frac{+\textit{Input voltage (V) x 32000}}{\textit{10 volts}}$$

$$\text{0 to 20 mA Input Range Mode, Digital Word (WX)} = \frac{+\textit{Input current (mA) x 32000}}{\textit{20 mA}}$$

Bipolar Mode Conversion

The following equations may be used to calculate the digital word which will result from a particular voltage or current input in the bipolar input mode:

$$\text{–5 to 5 V Input Range Mode, Digital Word (WX)} = \frac{\pm\textit{Input voltage (V) x 32000}}{\textit{5 volts}}$$

$$\text{–10 to 10 V Input Range Mode, Digital Word (WX)} = \frac{\pm\textit{Input voltage (V) x 32000}}{\textit{10 volts}}$$

$$\text{–20 to 20 mA Input Range Mode, Digital Word (WX)} = \frac{\pm\textit{Input current (mA) x 32000}}{\textit{20 mA}}$$

Example Conversion

Figure 1-4 illustrates the effects of a change in input level going from 0.3125 to 0.625 mV in the 0 to 5 V unipolar input mode. (For the 0 to 10 V and 0 to 20 mA unipolar input modes, or the bipolar modes, refer to the formulas above to determine the digital word which results from a particular input.)

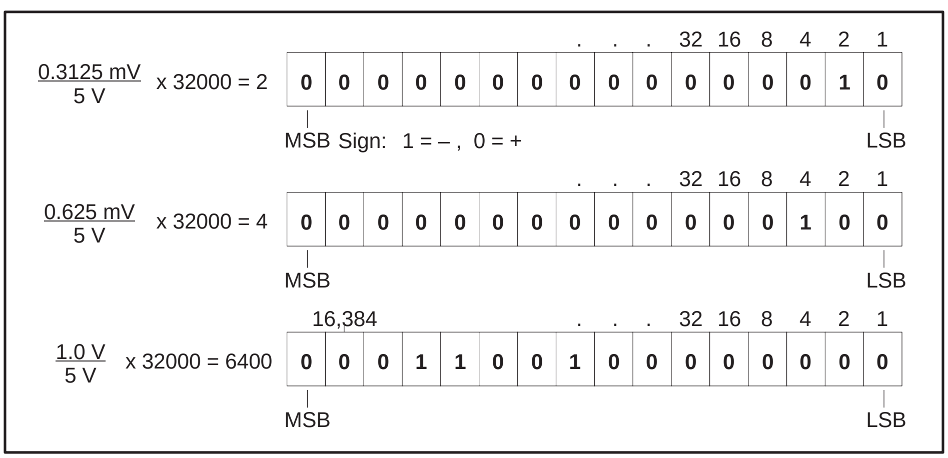


Figure 1-4 Example of Change in Input Level

1.5 Effect of Out-of-Range Input Signals

Overview

The PPX:505-2555 Differential Analog Input Module utilizes the overrange and underrange bit to indicate when a channel has reached individual limits. The value of the overrange or underrange condition varies from channel to channel. The reason for this is that as a channel is calibrated, all of the gains and offsets and dynamic ranges of the analog-to-digital converter of the system are compensated for in each analog input channel. Therefore, the point at which the analog-to-digital converter reaches a saturation point and can no longer produce a change in counts for a corresponding change in input signal is called the overrange or underrange limit of the channel. This level is different for every channel.

In the figures below, the limits for the overrange and underrange values are the minimum limits for a given channel. The actual limits for an individual channel may be greater.

Unipolar Mode

Figure 1-5 shows the voltage input limits for unipolar mode. Signals falling above or below the upper and lower limits in 0 to 5 V input mode or 0 to 10 V input mode are translated into a digital word that includes the addition of bit 16 to indicate an overrange or underrange condition. Note that although the digital word may approach zero as the analog input signal approaches the minimum for a given range, the digital word will never actually be zero. In fact, the underrange capability of any channel in unipolar mode may produce a negative value to the controller for a number of counts before the underrange bit is set.

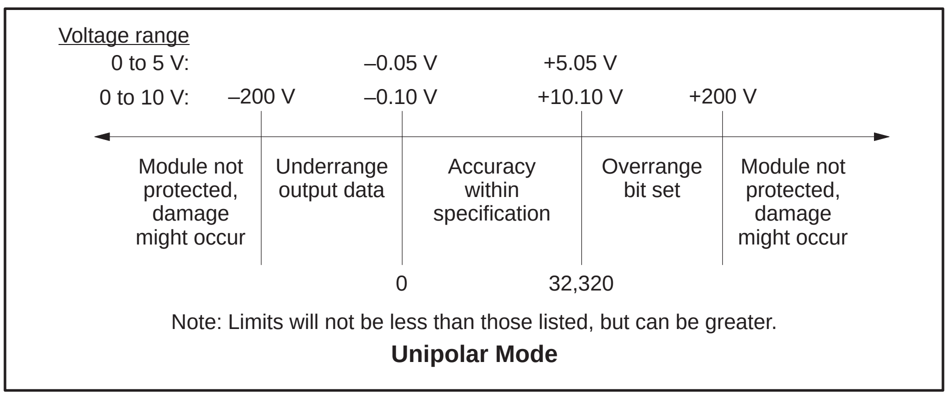


Figure 1-5 Voltage Input Limits (Unipolar)

Figure 1-6 and Figure 1-7 show the binary values of typical overrange and underrange conditions for unipolar mode.

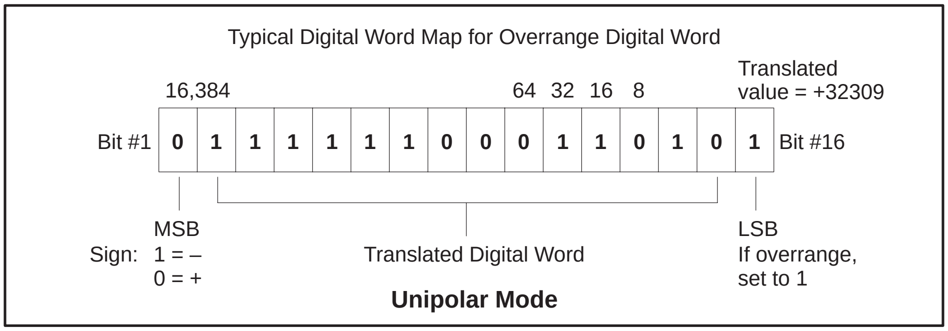


Figure 1-6 Typical Unipolar Overrange Word Value

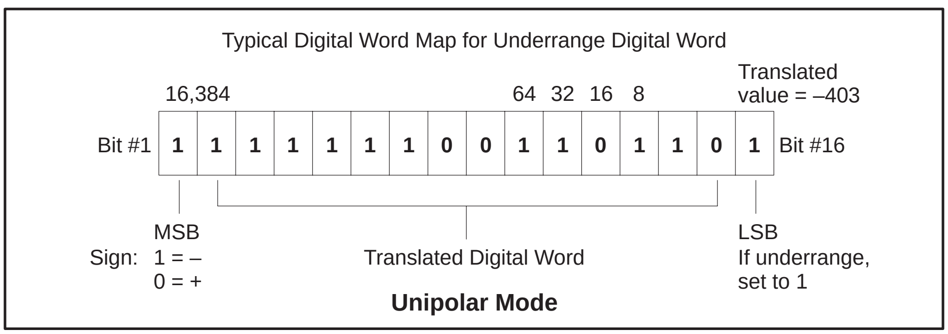


Figure 1-7 Typical Unipolar Underrange Word Value

Effect of Out-of-Range Input Signals (continued)

Bipolar Mode

Figure 1-8 shows the voltage input limits for bipolar mode. In bipolar mode, signals above or below the upper and lower limits in the –5 to +5 VDC or –10 to +10 VDC range are translated to a digital word and also utilize the overrange or underrange bit. The actual limit for each channel will vary from channel to channel as described above.

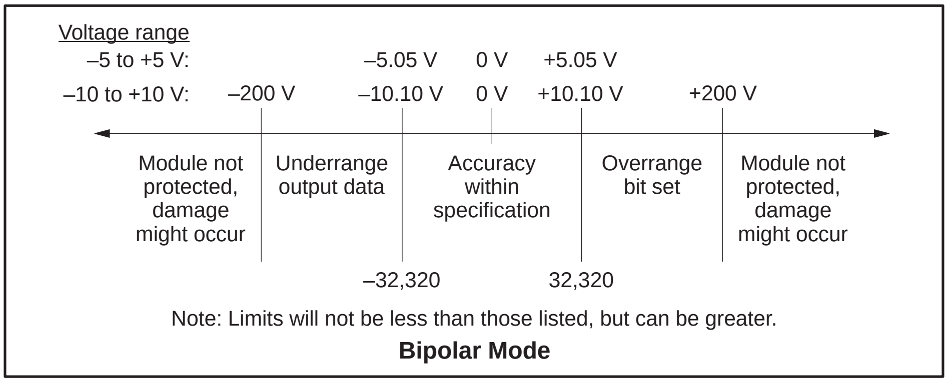


Figure 1-8 Voltage Input Limits (Bipolar)

Figure 1-9 and Figure 1-10 show the binary values of typical overrange and underrange conditions for bipolar mode.

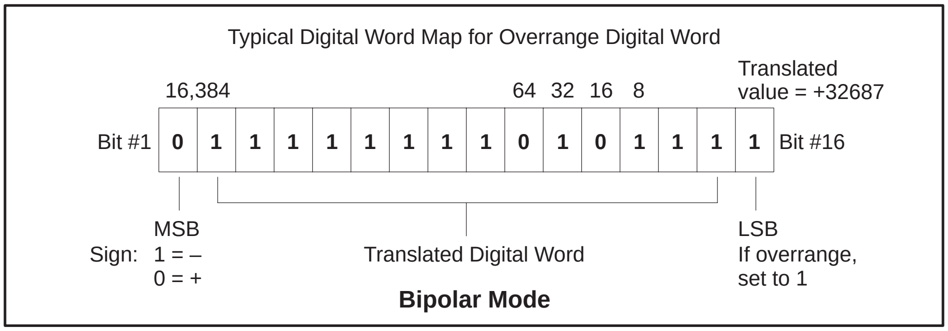


Figure 1-9 Typical Bipolar Overrange Word Value

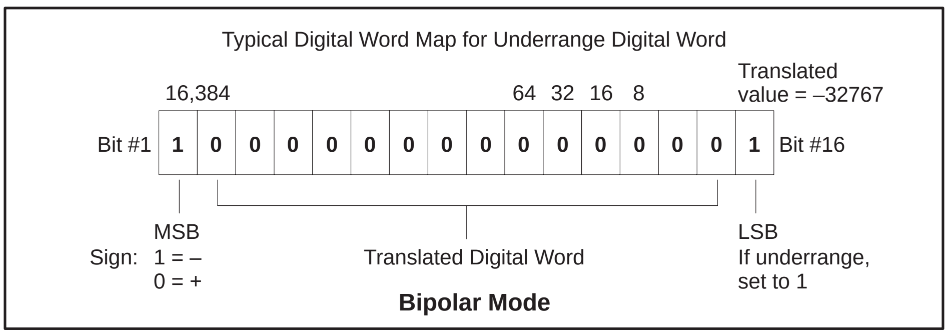


Figure 1-10 Typical Bipolar Underrange Word Value

1.6 Using 20% Offset

Using the Module with 20% Offset

Most applications use transducers that provide 1 to 5 volt (4 to 20 mA) input signals instead of 0 to 5 volt (0 to 20 mA) input signals. You can allow for this 20% offset by including some additional instructions in your RLL (Relay Ladder Logic) program.

First, subtract 6400 from the input data word (WX). Then, multiply the result by 125 and divide the product by 100. This yields the following equation:

$$\frac{(WX-6400) \times 125}{100} = 20\% \text{ offset data word}$$

Consult your *SIMATIC 545/555/575 Programming Reference User Manual* for information about the RLL instructions used in the conversion.

1.7 Resolution

Unipolar Mode Resolution

In unipolar input mode, the module has a resolution of 2 counts out of 32000. That is, the smallest unit into which the module will divide an input is 1 part out of 16000. This relationship can be shown as:

$$\frac{\text{2 counts per step}}{\text{32000 counts full scale}} = \frac{1}{16000}$$

Bipolar Mode Resolution

In bipolar mode, the resolution is 4 counts out of 32000, so that the smallest unit into which the module will divide an input is 1 part out of 8000. This relationship can be shown as:

$$\frac{\text{4 counts per step}}{\text{32000 counts full scale}} = \frac{1}{8000}$$

When using the module with 20% offset, module resolution remains at 2 counts out of 32000, but offset resolution becomes 4 counts out of 32000 as a result of the multiplication and division of the incoming data word.

Input Resolution

Table 1-1 shows the corresponding input resolution per step for each of the input configuration modes:

Table 1-1 Input Resolution

	Range Configuration	Digital Counts/Step	Input Resolution Per Step
Unipolar	0 – 5 VDC	2	0.3125 mV
	0 – 10 VDC	2	0.625 mV
	0 – 20 mA	2	1.25 µA
Unipolar with 20% Offset	1 – 5 VDC	4	0.625 mV
	4 – 20 mA	4	2.50 µA
Bipolar	–5 – +5 VDC	4	0.625 mV
	–10 – +10 VDC	4	1.25 mV
	–20 – +20 mA	4	2.50 µA

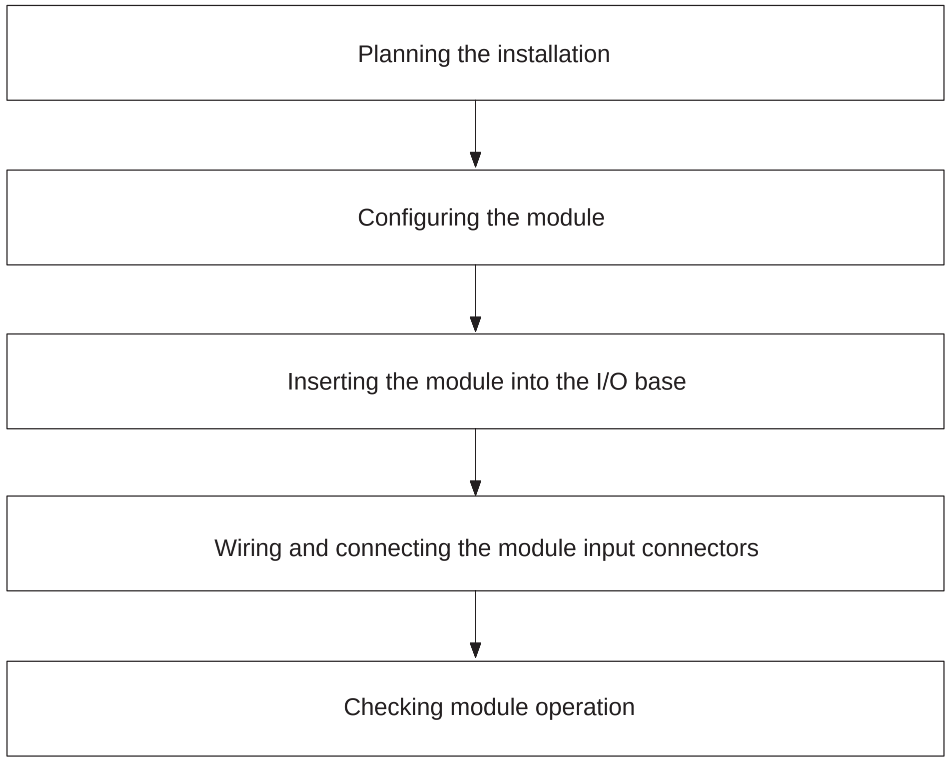
Chapter 2

Installation

2.1 Getting Started

Overview of Installation Procedure

The installation of the Sixteen Channel Analog Input Module involves the following steps:



The steps listed above are explained in detail in the following pages.

2.2 Planning the Installation

Overview

Planning is the first step in the installation of the module. This involves calculating the I/O base power budget and routing the input signal wiring to minimize noise. The following sections discuss these important considerations.

Calculating the I/O Base Power Budget

The PPX:505-2555 requires 5.0 watts of +5 VDC power from the I/O base. Use this value to verify that the base power supply capacity is not exceeded.

Input Signal Wiring

Input signal wiring must be shielded twisted-pair cable. The shielding for the cable should always be terminated at the module. Each group of four input channels contains two termination points for the shield wire. Since the cable shielding is grounded at the module, it should not be connected at the opposite end.

The shield wire should be terminated only at the designated shield terminals to minimize the effects of noise on the measuring system.

Note the following general considerations when wiring the module:

- Always use the shortest possible cables
- Avoid placing low voltage wire parallel to high energy wire (if the two wires must meet, cross them at a right angle)
- Avoid bending the wire into sharp angles
- Use wireways for wire routing
- Avoid placing wires on any vibrating surface

Unpacking the Module

Open the shipping carton and remove the special anti-static bag which contains the module.

> ⚠ **CAUTION**
>
> **The components on the PPX:505-2555 module printed circuit card can be damaged by static electricity discharge. To prevent this damage, the module is shipped in a special anti-static bag.**
>
> **Static control precautions should be followed when removing the module from the bag, when opening the module, and when handling the printed circuit card during configuration.**

After discharging any static build-up, remove the module from the static bag. Do not discard the static bag. Always use this bag for protection against static damage when the module is not inserted into the I/O backplane.

2.3 Configuring the Module

Overview

The Sixteen Channel Analog Input Module must be configured for voltage or current inputs, voltage range, unipolar/bipolar mode, and digital filtering/no filtering mode before wiring the input connector and inserting the module into the I/O base.

As shipped, all input channels are configured for current inputs, 5 V range, unipolar mode, and digital filtering enabled (see Table 2-1).

NOTE: The 5 V input signal range configuration is used for both 0 to 5 VDC and 1 to 5 VDC or 4 to 20 mA and 0 to 20 mA input signal ranges.

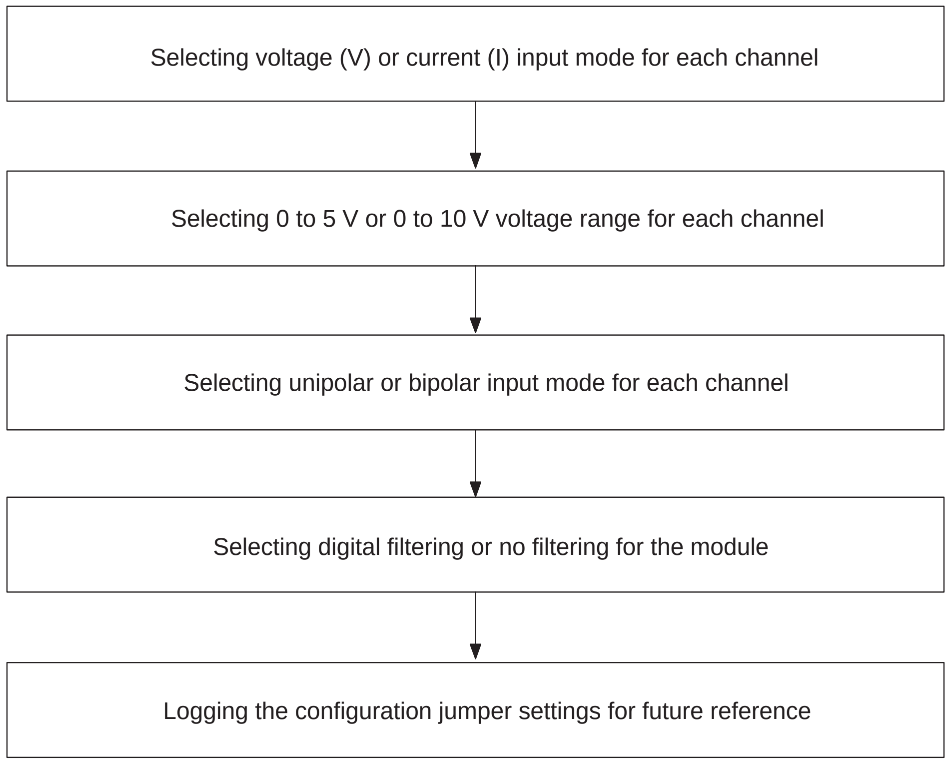
Table 2-1 Factory Configuration Jumper Settings

Channel Number	Voltage/ Current Jumper		Jumper Position V or I	Voltage Range Jumper	Jumper Position 5 V or 10 V	Unipolar/ Bipolar Jumper	Jumper Position UNI or BIP
1	JP1	1	I	JP5	5 V	JP5	UNI
2		2	I	JP6	5 V	JP6	UNI
3		3	I	JP7	5 V	JP7	UNI
4		4	I	JP8	5 V	JP8	UNI
5	JP2	5	I	JP9	5 V	JP9	UNI
6		6	I	JP10	5 V	JP10	UNI
7		7	I	JP11	5 V	JP11	UNI
8		8	I	JP12	5 V	JP12	UNI
9	JP3	9	I	JP13	5 V	JP13	UNI
10		10	I	JP14	5 V	JP14	UNI
11		11	I	JP15	5 V	JP15	UNI
12		12	I	JP16	5 V	JP16	UNI
13	JP4	13	I	JP17	5 V	JP17	UNI
14		14	I	JP18	5 V	JP18	UNI
15		15	I	JP19	5 V	JP19	UNI
16		16	I	JP20	5 V	JP20	UNI

All Channels	Unipolar/ Bipolar Switches	Voltage Range Switches	Digital Filtering Jumper	Jumper Position FIL/none
1–16	SW7 SW8	SW5 SW6	JP121	FIL

Changing the Configuration

Changing the module input channel configuration involves the following steps:



Each of these steps is described in the following sections.

Selecting Voltage or Current Input Mode (JP1, JP2, JP3, JP4)

Locate the 16 Voltage/Current Jumpers corresponding to input channels 1 through 16. See Figure 2-1 for the location of these jumpers. For each input channel, select current mode by placing the jumper in the “Current” position or voltage mode by placing the jumper in the “Voltage” position. For each input channel set to current mode, you must set the corresponding Voltage Range Jumper to the 5 V position as described in the following section.

The silkscreen on the printed circuit board is clearly marked to indicate the voltage or current position for each channel.

NOTE: Each channel utilizes jumpers to configure the hardware and DIP switches to configure the microcomputer.

Selecting Voltage Range (JP5–JP20)

Locate the Voltage Range Jumpers corresponding to input channels 1 through 16 (see Figure 2-1). For each input channel operating in current mode, set the corresponding Voltage Range Jumper to 5 V.

CAUTION

Failure to properly configure each input channel for current mode could result in damage to equipment.

Ensure you set the corresponding Voltage Range Jumper to 5 V.

For each input channel operating in voltage mode, set the corresponding Voltage Range Jumper to 5 V for 0 to +5 VDC input range or 10 V for 0 to 10 VDC or –10 to +10 VDC input range. Locate DIP switches SW5 and SW6 and for each channel select the voltage range as previously selected with the jumpers.

Selecting Unipolar or Bipolar Input Mode

Locate the Unipolar/Bipolar Jumpers JP5 through JP20 (see Figure 2-1). For each channel select UNI or BIP for Unipolar or Bipolar mode. Next set DIP switches SW7 and SW8 for each channel to the same selection as the corresponding jumpers JP5–JP20.

Selecting Digital Filtering

Locate the Digital Filtering/No Filtering Jumper JP121 (see Figure 2-1). To enable digital filtering, set the jumper in the FIL position. Since many analog input signals contain noise, use digital filtering unless maximum response time is required.

Digital Filter Time Constant

The time constant for the module is 25 milliseconds. An input signal from zero to full scale will require 4 to 5 time constants to reach a final value. Therefore the effect of digital filtering will slow the response of the module to 100 milliseconds.

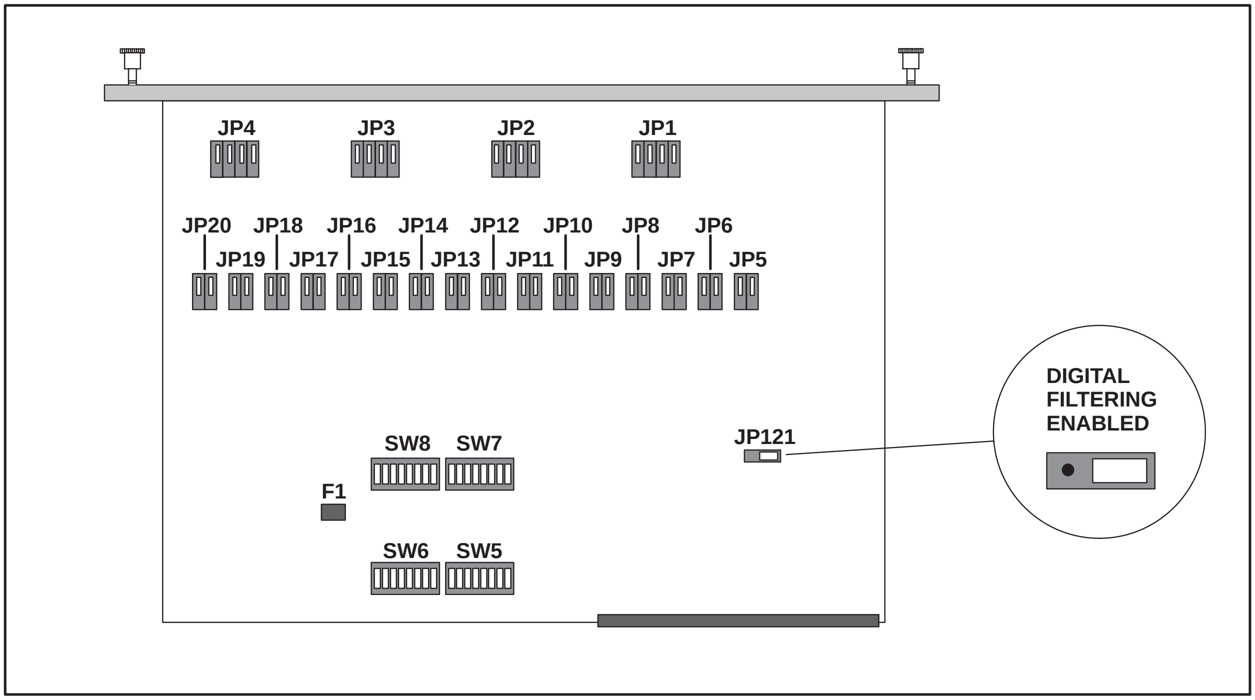


Figure 2-1 Configuration Jumper Locations

2.4 Installing the Module

Inserting the Module Into the I/O Base

Insert the module into the I/O base by carefully pushing the module into the slot. When the module is fully seated in the slot and backplane connector, tighten the captive screws at the top and bottom to hold the module in place. To remove the module from the I/O base, loosen the captive screws, then remove the module from the I/O base. Be careful not to damage the DIN connector at the back of the module when inserting or removing the module.

> **WARNING**
>
> **Failure to remove power before inserting the module into the I/O rack could result in damage to equipment and/or injury to personnel.**
>
> **Remove all power to the I/O rack before inserting module.**

Wiring the Input Connectors

Input signals are accepted through a connector assembly located on the front of the module. The connector assembly consists of a standard Series 505 wiring connector (see Figure 2-5). Wiring is connected through the screw terminal plug. The screw terminals can accept wire sizes up to single-stranded 14 gauge wire. The actual size wire used depends on the external device providing the input signal. Consult the device manufacturer's recommendations for selecting the input wire size.

To assign an input to a specific channel, locate the appropriate channel position on the screw terminal plug as shown in Figure 2-2.

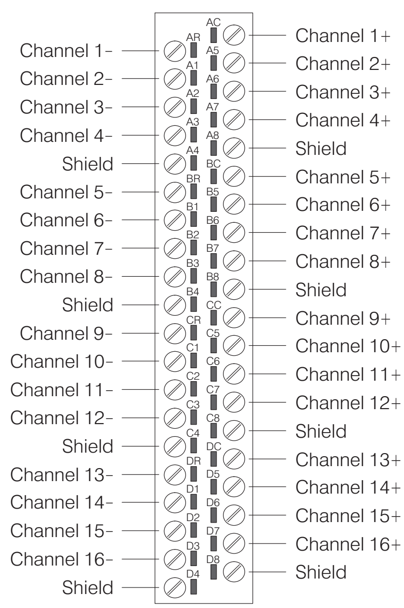


Figure 2-2 Screw Terminal Plug Wiring

Connecting Voltage Input Wiring

For voltage input circuits, connect the signal wire to the + (positive) screw terminal, and the return wire to the – (negative) screw terminal.
The ground terminals labeled SHIELD provide a convenient location to terminate the shield. Insert the wires in the appropriate holes on the front of the connector adjacent to the corresponding screw. When the wires are inserted, tighten the screws. Repeat this procedure for the remaining voltage input channels. The inputs of this module are full differential input amplifiers that may be driven in a differential or single-ended mode. See Figure 2-3.

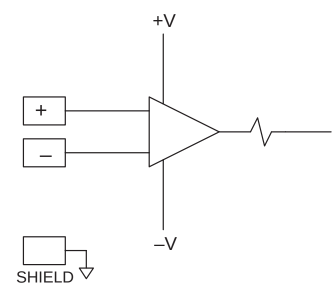


Figure 2-3 Typical Internal Circuit — Voltage Mode

Connecting Current Input Wiring

For current input circuits, connect the signal wire to the + (positive) screw terminal, and the return wire to the – (negative) screw terminal.
The ground terminals labeled SHIELD provide a convenient location to terminate the shield. Insert the wires in the appropriate holes on the front of the connector adjacent to the corresponding screw. When the wires are inserted, tighten the screws. Repeat this procedure for the remaining current input channels. See Figure 2-4.

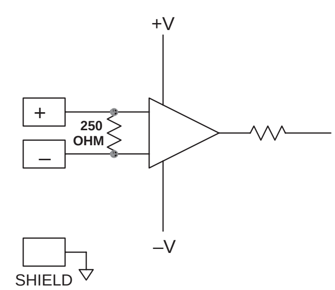


Figure 2-4 Typical Internal Circuit — Current Mode

NOTE: No external current resistor is required in current mode.

Inserting the Screw Terminal Connector

When all the input signal wires are connected to the screw terminal, align the edge of the printed circuit board with the corresponding edge of the wiring connector, and press the connector on the circuit board until the connector is fully seated. Next, align the captive screws on the top and bottom of the connector with the front panel and tighten until the module connector is fully seated. See Figure 2-5.

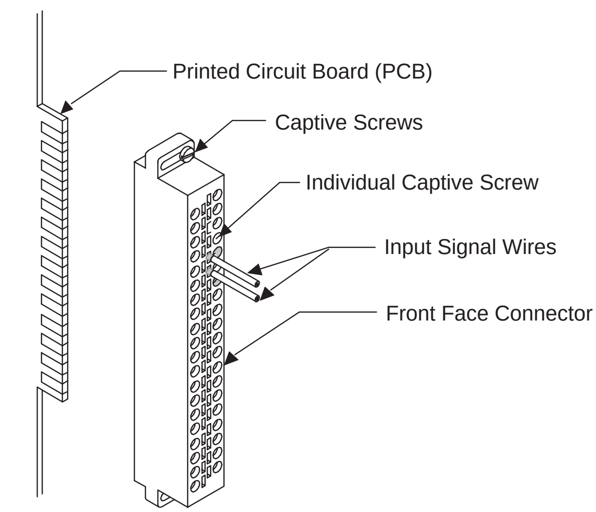


Figure 2-5 Input Connector Assembly

2.5 Checking Module Operation

Checking Module Status

First turn on the base power supply. If the module diagnostics detect no problems, the status indicator on the front of the module will light. If the status indicator does not light, blinks, or goes out during operation, the module has detected a failure. For information on viewing failed module status, refer to your *SIMATIC TISOFT User Manual*. To diagnose and correct a module failure, refer to the next section on troubleshooting.

Checking Module Configuration in Controller Memory

You must also check that the module is configured in the memory of the controller. This is important because the module will appear to be functioning regardless of whether it is communicating with the controller. To view the controller memory configuration chart listing all slots on the base and the inputs or outputs associated with each slot, refer to your *SIMATIC TISOFT Programming Manual*. An example chart is shown in Figure 2-6. The PPX:505-2555 logs in to the controller as 16 WX inputs.

```
505 I/O MODULE DEFINITION FOR CHANNEL . 1       BASE . . . 00
            I/O        NUMBER OF BIT AND WORD I/O      SPECIAL
 SLOT     ADDRESS       X       Y       WX      WY     FUNCTION
  01 . . . . . 0001 . . . . . .  00 . . . . 00 . . . . 16 . . . 00 . . . . . . . NO
  02 . . . . . 0000 . . . . . .  00 . . . . 00 . . . . 00 . . . 00 . . . . . . . NO
   .
   .
   .
  15 . . . . . 0000 . . . . . .  00 . . . . 00 . . . . 00 . . . 00 . . . . . . . NO
  16 . . . . . 0000 . . . . . .  00 . . . . 00 . . . . 00 . . . 00 . . . . . . . NO
```

Figure 2-6 Example I/O Configuration Chart

In this example, the PPX:505-2555 module is inserted in slot 1 in I/O base 0. Data for channel 1 appears in word location WX1, data for channel 2 appears in word location WX2, etc. For your particular module, look in the chart for the number corresponding to the slot occupied by the module. If word memory locations appear on this line, then the module is registered in the controller memory and the module is ready for operation.

If the line is blank or erroneous, re-check the module to ensure that it is firmly seated in the slots. Generate the controller memory configuration chart again. If the line is still incorrect, contact the Siemens Energy & Automation, Inc., Technical Services Group in the U.S.A. at 423–461–2522. In other countries, you can also contact the nearest Siemens distributor.

Chapter 3
Advanced Function Programming

3.1 Advanced Software Functions

Introduction

As PLC control systems become more complex, the need for real-time processing of analog signals is needed at the I/O level. Current implementations using the 505 controllers utilize analog alarm blocks and/or special function programs within the controller. The PPX:505-2555 analog input module from Siemens Energy & Automation, Inc., can reduce the program complexity and scan time by performing this signal preprocessing in the module.

Scaling, alarming, peak/valley hold, digital filtering, and averaging are available on a per-channel basis and are selected through a simple PLC configuration routine. When these advanced functions are enabled, the module logs in as 16X / 16Y / 32WX / 32WY. A jumper on the module selects the standard 16WX login or the high-density advanced function interface. Each channel can also be set through hardware settings for voltage or current input, unipolar or bipolar operation, and 5 V or 10 V range.

Overview of the Advanced Functions

Each of these functions can be selected on a per-channel basis, and each channel can have any function in any combination, e.g. alarming on a scaled value which is digitally filtered and set for peak hold. (See Section 3.4 for timing considerations.)

Scaling Each channel can be configured with low and/or high scale value. A flowmeter that outputs 0 mA @ 5 cfm and 20 mA @ 50 cfm would have a low scale of 5 and a high scale of 50. An operator interface attached to the controller could then read the analog values directly in engineering units without having to run a Special Function program to scale the input. A standard 20% offset mode is also available for 4–20 mA signals.

Alarming Each channel can be assigned a low and/or high alarm value. No analog alarm blocks are needed in the controller. Alarming occurs real-time as the signal is processed by the module. Two WX words are used to indicate high and low alarm conditions (bit 1 = channel 16, etc.). A third WX word is the logical OR of the high and low alarms.

Peak/valley hold The peak or valley of a rapidly changing analog signal has been impossible to detect unless an external circuit was used. The PPX:505-2555 makes possible the detection of a peak or valley and holds that value until reset by the controller. The peak/valley measurement is available to the controller at the same time as the currently measured analog value.

Averaging This option is used to “clean up” a signal that is at a steady state, e.g., a sensor riding on a liquid tank with riplets. The user specifies how many signal scans to average and this value is presented to the PLC.

Digital filtering This has the effect of a moving average operation (actually it is an Infinite Impulse Response filter), and is useful to smooth out the high frequency noise on a changing analog signal. See Section 3.4.

All of these advanced function options are designed to be stored in the controller in a V-memory or K-memory table and downloaded to the module. The advantages of this method over a communications port on the module are greater flexibility, easier maintenance, and reduced documentation.

The controller can change any function “on the fly” if changing process conditions require (for example, a process needs tighter control, therefore narrower alarm limits). Any replacement module can be downloaded from the controller, which eliminates the need for a cable, a laptop computer and the most recent documentation.

Setting the Module Configuration Jumper for Advanced Mode

Before you begin to use the advanced mode of the PPX:505-2555, all of the hardware functions, such as voltage range input levels, current input mode, unipolar or bipolar level, etc., should be set up in accordance with the instructions in Chapter 1 and Chapter 2.

The advanced functions require a jumper (JP122) to be moved on the module. Move the jumper to the right position to enable the high-density mode of operation (see Figure 3-1).

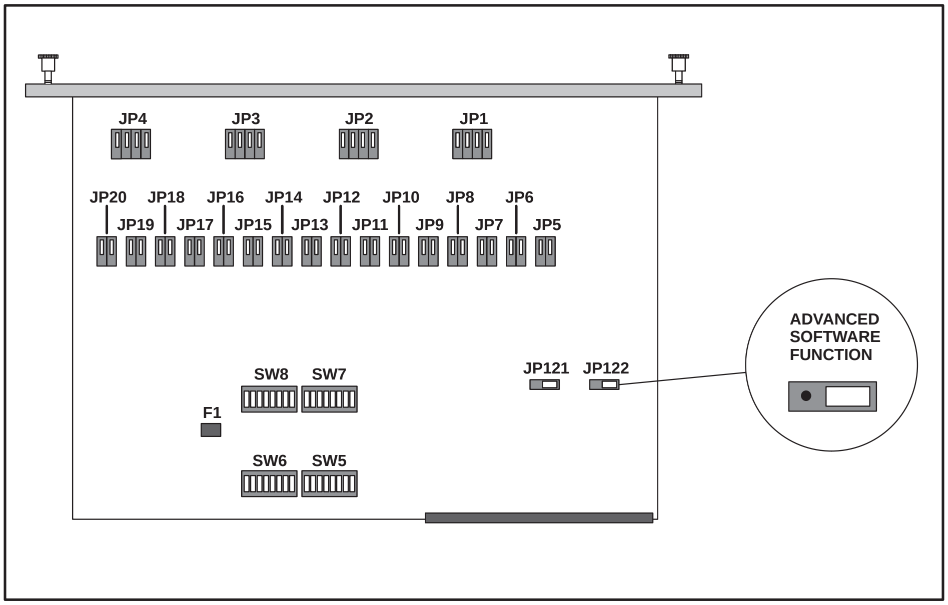


Figure 3-1 Configuring the PPX:505-2555 for Advanced Functions

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NOTE: In the advanced operations mode, the position of jumper JP121 (Digital Filtering Enable) is ignored.

Logging the Module in the Controller I/O Configuration Memory

First turn on the base power supply. If the module diagnostics detect no problems, the status indicator on the front of the module will light. If the status indicator does not light, blinks (or goes out during operation), the module has detected a failure. For information on viewing failed module status, refer to your *SIMATIC 505 TISOFT2 User Manual* (PPX:TS505–8101–x). To diagnose and correct a module failure, refer to the section on troubleshooting.

You must also check that the module is configured in the controller memory. This is important because the module will appear to be functioning regardless of whether it is communicating with the controller. To view the controller memory configuration chart listing all slots on the base and the inputs or outputs associated with each slot, refer to your *SIMATIC 505 TISOFT2 User Manual*. An example chart is shown in Figure 3-2. When the module is properly logged in to the controller as a high-density discrete and analog module the configuration is 16 X, 16 Y, 32 WX, and 32 WY registers.

```
505 I/O MODULE DEFINITION FOR CHANNEL . . . 1    BASE . . . . . 00

            I/O         NUMBER OF BIT AND WORD I/O        SPECIAL
SLOT      ADDRESS        X       Y       WX      WY       FUNCTION

  01 . . . . . . 0001 . . . . . . . . 16 . . . .  16 . . . . 32 . . . .  32 . . . . . . . . .  NO
  02 . . . . . . 0000 . . . . . . . . 00 . . . .  00 . . . . 00 . . . .  00 . . . . . . . . .  NO
  .
  .
  .
  15 . . . . . . 0000 . . . . . . . . 00 . . . .  00 . . . . 00 . . . .  00 . . . . . . . . .  NO
  16 . . . . . . 0000 . . . . . . . . 00 . . . .  00 . . . . 00 . . . .  00 . . . . . . . . .  NO
```

Figure 3-2 PPX:505-2555 I/O Configuration Chart

In this example, the module is inserted in slot 1 in I/O base 0. The first X point is assigned the first I/O address. In this example, the I/O assignments are: X1 . . X16, Y17 . . Y32, WX33 . . WX64, WY65 . . WY96. For your particular module, look in the chart for the number corresponding to the slot occupied by the module. If word memory and discrete locations appear on this line, then the module is registered in the controller memory and the module is ready for operation.

If the line is blank or erroneous, re-check the module to ensure that it is firmly seated in the slots. Generate the controller memory configuration chart again. If the line is still incorrect, contact your local distributor or Siemens Energy & Automation, Inc., Technical Services Group in the U.S.A. at 423–461–2522. In other countries, you can also contact the nearest Siemens distributor.

3.2 Internal Register Structures

Description of the I/O Registers

The PPX:505-2555 module in the high-density mode logs in to the controller as 32 WX input registers, 32 WY output registers and 16 X and 16 Y discrete inputs and outputs. This high-density configuration provides support for reading the raw data and the processed data, and for writing the configuration data to the module. Refer to Appendix D for a one-page summary of I/O assignments.

Starting login addresses and the locations of their corresponding registers are shown in Table 3-1.

Table 3-1 Input and Output Register Offsets

Starting Controller Address	**1**	**105**
X registers begin	1	105
Y registers offset 16	17	121
WX registers offset 32	33	137
WY registers offset 64	65	169

Input Registers

The word input content of the module consists of 32 WX input registers. These registers present the raw measured data and the processed data to the controller.

WX33 – WX48 contain the converted data in engineering units for the sixteen input channels, as shown in Table 3-2.

Table 3-2 Input Channel Data

WX33	Channel 1	Conversion data
.	.	.
.	.	.
WX48	Channel 16	Conversion data

Input registers WX49 – WX54 consist of special flag bits that may be interrogated in the controller ladder program to detect alarm conditions, overrange or underrange conditions, or arithmetic overflow conditions due to scaling operations. See Figure 3-3.

WX49	Channel 1–16	Alarm flag bits
WX50	Channel 1–16	High alarm flag bits
WX51	Channel 1–16	Low alarm flag bits
WX52	Channel 1–16	Overrange flag bits
WX53	Channel 1–16	Underrange flag bits
WX54	Channel 1–16	Arithmetic overflow flag bits
WX55	Reserved for future use	
.		
.		
WX64	Reserved for future use	

For each word, the bits are correlated to the channels according to the following:

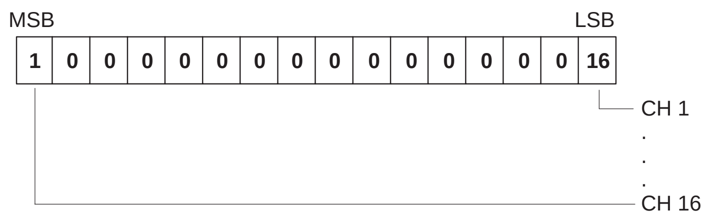

Figure 3-3 Input Flag Bits

If the peak or valley hold functions are enabled and Y31=1, then the data returned in WX49 – WX64 is the peak (Y30=1) or valley (Y30=0) value measured. See Table 3-3.

Table 3-3 Peak/Valley Hold Input Words

WX33	Channel 1	Conversion data
.	.	.
.	.	.
WX48	Channel 16	Conversion data

Output Registers

The PPX:505-2555 module also utilizes 32 WY registers. These registers are used to transfer the scaling values, the alarm setpoints, the filtering time constants, and the averaging count values to each of the sixteen channels.

After the data is loaded into the module, these registers then enable each of the functions on a channel-by-channel basis. These WY registers become control words for enabling each channel for special operations (Table 3-4).

Table 3-4 Output Data Registers

Alarms	WY65 . . WY80 WY81 . . WY96	Channel 1 Channel 16 Channel 1 Channel 16	Low alarm setpoint Low alarm setpoint High alarm setpoint High alarm setpoint
Scaling	WY65 . . WY80 WY81 . . WY96	Channel 1 Channel 16 Channel 1 Channel 16	Scaling low setpoint Scaling low setpoint Scaling high setpoint Scaling high setpoint
Digital Filtering	WY65 . . WY80	Channel 1 Channel 16	Settling time Settling time
Averaging	WY81 . . WY96	Channel 1 Channel 16	Average sample counts Average sample counts

After the values are loaded to the module, WY registers are used like those shown in Table 3-5.

Table 3-5 Function Enable Bits

WY65	Channel 1–16	Low alarm enable bits
WY66	Channel 1–16	High alarm enable bits
WY67	Channel 1–16	Scaling enable bits
WY68	Channel 1–16	Digital filtering enable bits
WY69	Channel 1–16	Averaging enable bits
WY70	Channel 1–16	Peak hold enable bits
WY71	Channel 1–16	Valley hold enable bits
WY72	Channel 1–16	Offset mode enable bits
WY73	Channel 1–16	Peak hold reset bits
WY74	Channel 1–16	Valley hold reset bits
WY75	Channel 1–16	Averaging reset with new value bits
WY76–96		(Not used)

Control Registers

The control registers (X and Y discrete I/O points) are the handshake bits and steering logic used to load the data into the module and to request special operations from the module. These registers consist of the discrete inputs and outputs of the module.

Inputs

Only one input bit, X16, is used. This bit is used by the module to inform the controller that the module is ready to accept data (see Figure 3-4).

X16	**Module_Ready** flag
0	busy
1	ready for transfer

Figure 3-4 Module_Ready Bit

Before any transfers are made to the module, the relay ladder program should examine the state of this input. When the input is true, the loading operation may begin.

Outputs

The discrete output points consist of Y17 – Y32.

Y17 – Y19 are used to identify the data being transferred. As data is loaded to the module, the state of these bits identifies the type of data being transferred (see Table 3-6). The module decodes these bits and processes the data accordingly.

Table 3-6 Data Identification Bits

Y19	Y18	Y17	Data Transfer Type
0	0	0	No operation
0	0	1	Function enable bits
0	1	0	Low/High alarm setpoint values
0	1	1	Scaling low/high values
1	0	0	Filtering time constant/Number of averages

In addition, Y27 – Y32 are used to reset averaging, reset valley hold values, reset peak hold values, read peak or valley values, read flags, and to write data to the module. See Figure 3-5.

Y27	Averaging reset
1	Resets averaging on all channels to new values loaded
Y28	Valley hold reset
1	Reset valley hold
Y29	Peak hold reset
1	Reset peak hold
Y30	Read peak hold/valley hold
0	Read valley hold values
1	Read peak hold values
Y31	Read peak hold/valley hold or Read flags
0	Read flags
1	Read peak hold/valley hold values

NOTE: In operation, the state of Y31 determines whether WX49 — WX64 return peak/valley data or the flag bits defined in Figure 3-3. If Y31 is on, then the type of data (valley hold or peak hold) is selected with Y30.

Y32	Data_Ready, controller to module data ready flag
0	no data
1	data ready to transfer

Figure 3-5 Data Transfer Control Bits

Loading Data into the PPX:505-2555 Module

The process by which data is loaded into the PPX:505-2555 module is shown in Figure 3-6.

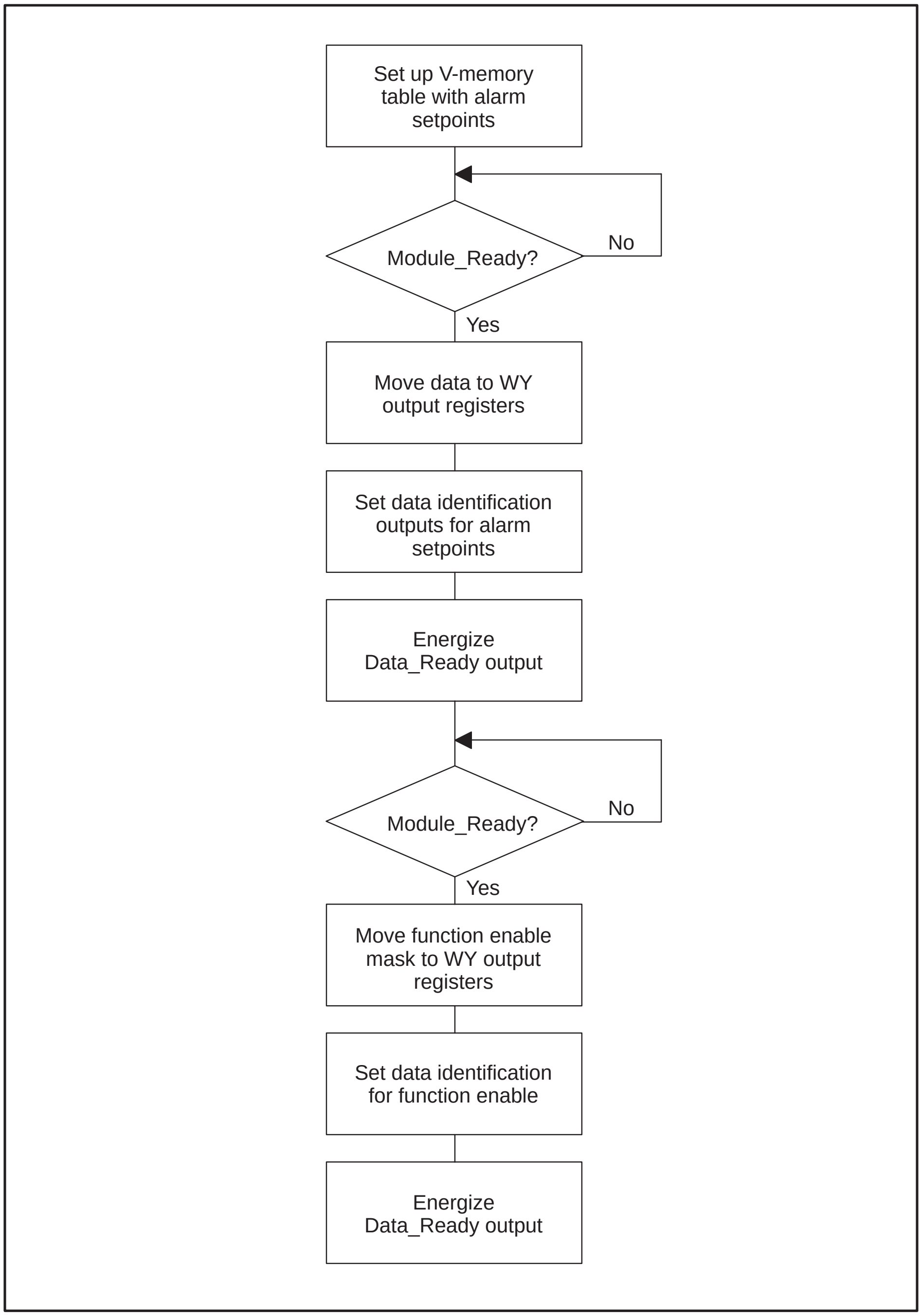

Figure 3-6 Data Loading Process

The following steps explain how data is loaded into the PPX:505-2555 module.

1. V- or K-memory tables are constructed with the scaling, alarm setpoints, filtering and averaging units. In the example below, low alarm and high alarm setpoints are loaded for each channel from V1 through V32. V1 – V16 contain the low alarm setpoints for channels 1–16, and V17 – V32 contain the high alarm setpoints for channels 1–16. See Figure 3-7.

V1	100	V17	20,100
V2	200	V18	20,200
V3	300	V19	20,300
V4	400	V20	20,400
V5	500	V21	20,500
V6	600	V22	20,600
V7	700	V23	20,700
V8	800	V24	20,800
V9	900	V25	20,900
V10	1000	V26	21,000
V11	1100	V27	22,000
V12	1200	V28	23,000
V13	1300	V29	24,000
V14	1400	V30	25,000
V15	1500	V31	26,000
V16	1600	V32	27,000

Figure 3-7 Sample Low and High Alarm Setpoints

2. By monitoring the state of the Module_Ready flag, data is moved to the WY output registers. See Figure 3-8.

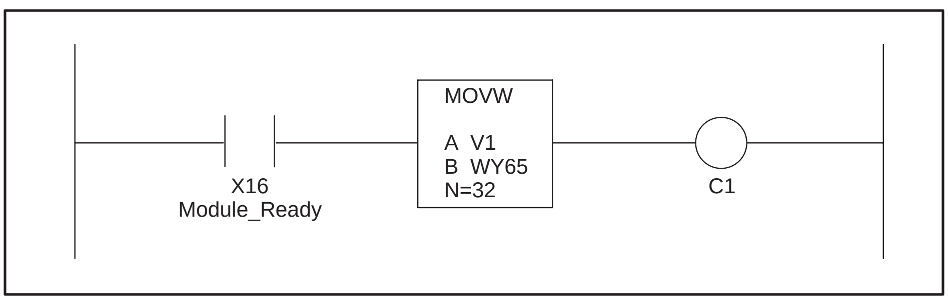

Figure 3-8 The Module_Ready Bit

3. The data identification outputs Y19 – Y17 are set according to the data being transferred. These are decoded by the module in order to distinguish the type of data being loaded (see Figure 3-9).

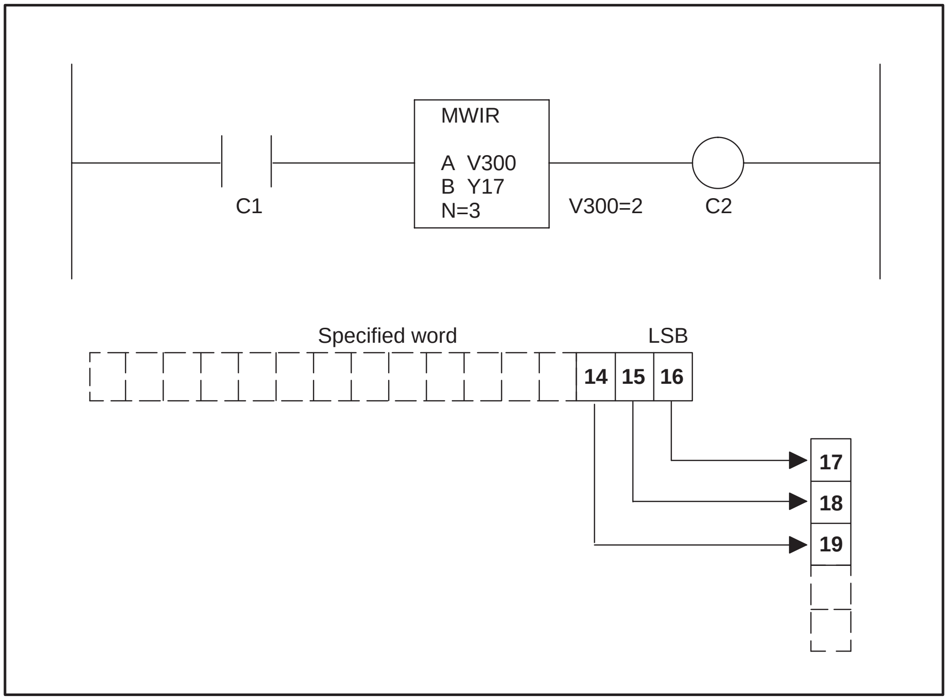

Figure 3-9 Identifying the Data Being Transferred

4. Y32 Data_Ready is energized to transfer the word data into the module (see Figure 3-10).

Figure 3-10 The Data_Ready Bit

5. The functions are enabled with the enable bits. WY65 and WY66 are set to all 1's with a MOVW instruction (see Figure 3-11).

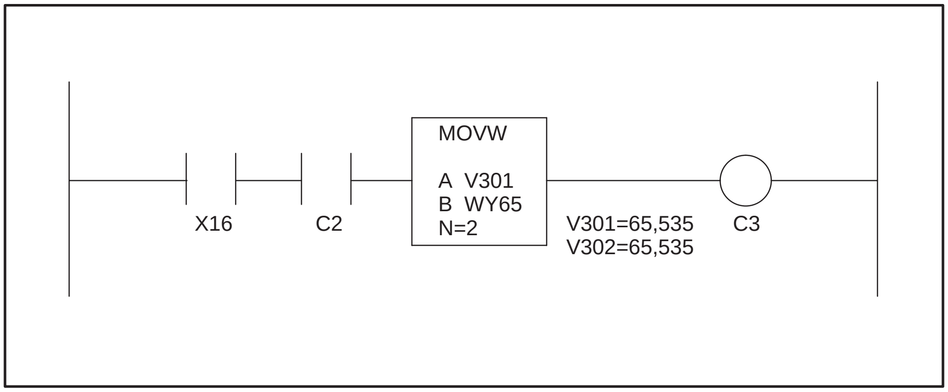

Figure 3-11 Enabling the Functions Loaded

6. With the Data_Ready bit, data is transferred with Y32 (see Figure 3-12).

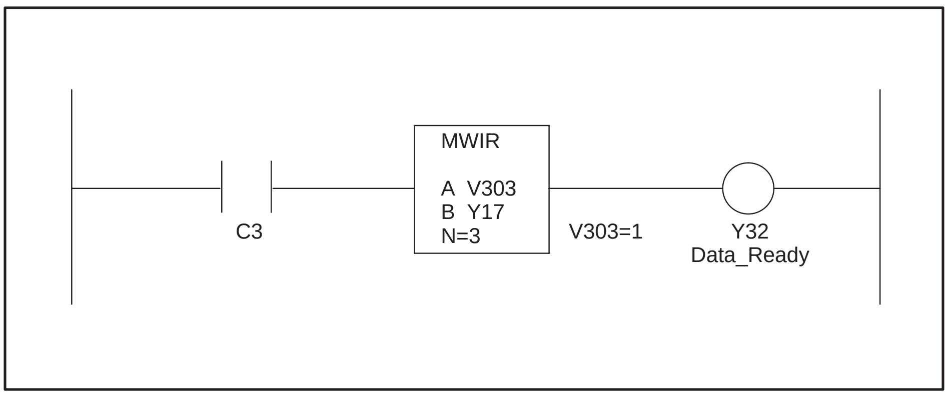

Figure 3-12 Loading the Enable Bits

3.3 Loading Programs into the I/O Module

Before entering relay ladder logic in the controller, utilize the worksheets in Appendices E and F to ensure a successful installation and start-up.

The following sample ladder program is provided to demonstrate how the data is loaded into the PPX:505-2555 module. Each channel is enabled for all functions supported.

In the program in Figure 3-13, a counter is used to load all of the functions into the module. When Module_Ready is true the data is moved from V-memory tables to the appropriate WY register. The data identification bits Y17 – Y19 are set with the SETI and RSTI instruction. When the rung is complete, the Data_Ready output Y32 is energized. As the counter is incremented, the next scan of the program loads another set of variables into the module. The first rung loads low and high alarm setpoints. The second rung loads the low and high scaling values. The third rung loads the filter time constants and the number of averages. The fourth rung loads enable bits for each function. The controller may selectively enable each channel for any function.

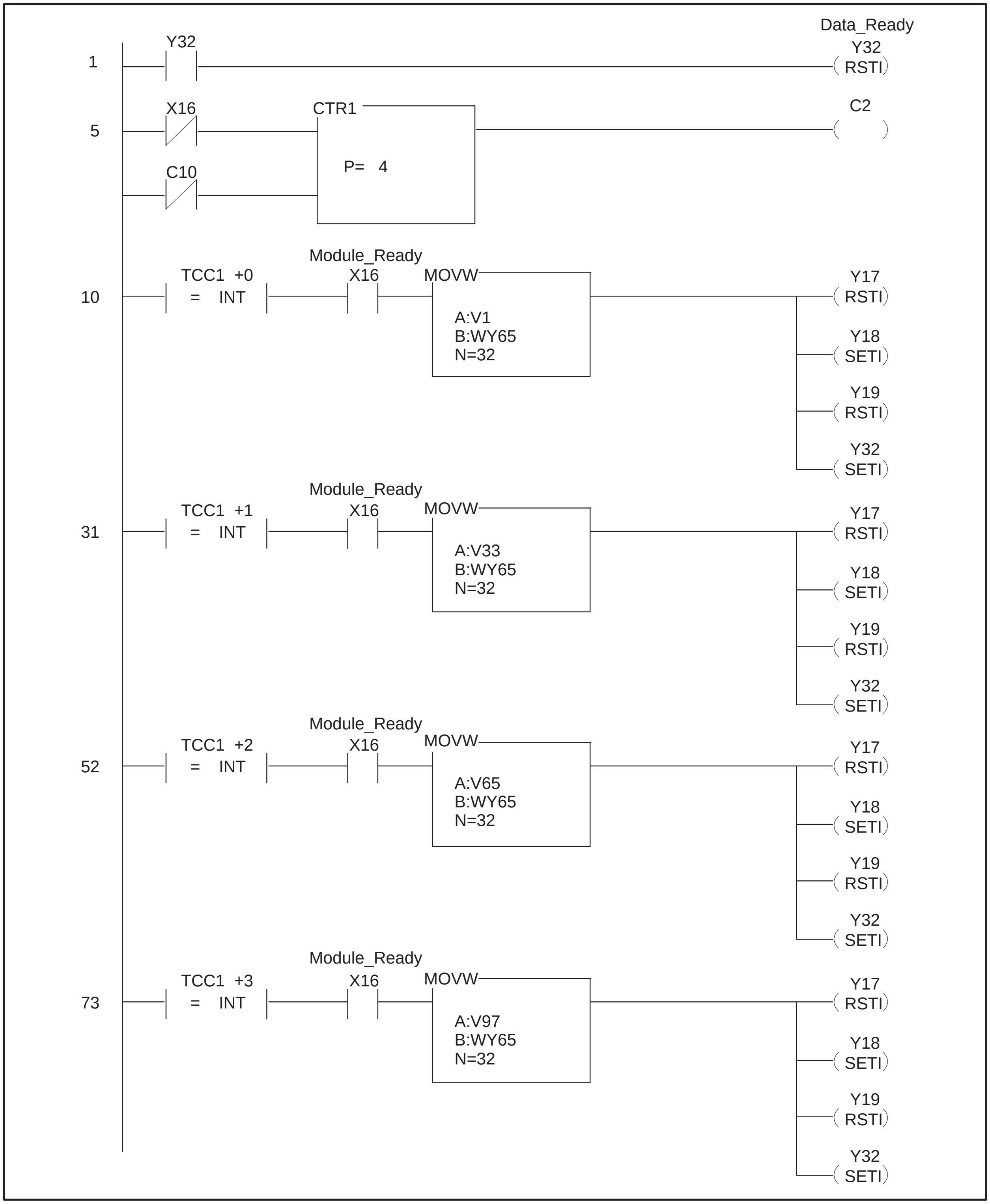

Figure 3-13 505-2555 Configuration Example Program

3.4 Timing Considerations

Without any of the advanced features enabled, the PPX:505-2555 module will update all 16 points in less than 6 msec. With all functions enabled for all 16 points, the module will update all 16 channels in less than 56 msec. Each function has a specific overhead associated with it and your application should consider the time delays to ensure that there is adequate time allowed for the processing of data.

Timing Constraints When Using Advanced Functions

Table 3-7 shows a chart of the overhead required for all 16 channels when each of the advanced functions is enabled. Operations such as scaling and offset mode require the greatest amount of time due to the multiplication and division in the microcomputer.

Table 3-7 Timing Overhead for Functions Enabled

Functions Enabled in Enhanced Mode (32 WX and 32 WY, 16 X and 16 Y)	**Time for All 16 Channels**
None	6.5 msec
Low alarm	7.73 msec
High alarm	7.73 msec
Scaling	27.1 msec
Offset mode	27.1 msec
Filtering	8.97 msec
Averaging	7.85 msec
Averaging reset (16 channels)	41.8 msec
Peak hold	7.65 msec
Valley hold	7.65 msec
Standard Mode (16 WX)	
No digital filtering	5.80 msec
Filtering enabled	8.20 msec

3.5 Additional Information about Each Function

Default Values

There are default values for every function that is supported. If no data is transferred to the module and the enable bits for a function are set and written to the module, then the default values will be used. See Table 3-8.

NOTE: No matter what functions are enabled, the actual hardware data from the I/O channel is always present in WX33 – WX48.

Table 3-8 Default Function Values

Functions Enabled	Low Default Value	High Default Value
Alarm setpoints	1000	31,000
Scaling engineering units	0	32,000
Offset mode 4–20 mA	6400	32,000
Filtering time constants	250 msec	
Averaging	20 averages	
Peak hold	0	0
Valley hold	0	0

Offset Mode

In the simplest scaling mode, an offset calculation may be enabled without writing any values into the module. If the offset bits are enabled in the WY register for each channel and the data is written to the module with the Y32 output, then values of 6400 and 32000 will automatically be used for scaling. A 4 mA or 1 VDC input will read 0 in the controller, and a 20 mA or 5 VDC input will read 32000.

Offset mode may also be used with scaling. The offset operation is performed first and then the values are scaled to the user-defined low engineering units and high engineering units.

Additional Information about Each Function (continued)

Scaling

Unipolar Inputs Values used in scaling are interpreted in the following manner. For unipolar inputs, a value of 0 VDC will be scaled to the low engineering unit and a value of +10 VDC or +5 VDC will be scaled to the high engineering unit.

Bipolar Inputs For Bipolar inputs, an external voltage of –10 VDC or –5 VDC will be scaled to the low engineering unit and a value of +10 VDC or +5 VDC will be scaled to the high engineering unit.

Numerical Range All numbers used for scaling are expressed as signed integers.

The numerical range for scaling is +/– 32767. If a value of –32768 is loaded into the module, then the value will be adjusted in the module to –32767.

Arithmetic Overflow Scaling operations may result in arithmetic overflow. Errors of this kind for each channel may be detected with the WX54 arithmetic overflow bits.

Overflow conditions can occur during normalization of the input value. If the input word reaches + 32767 or –32767 before the ADC (analog-to-digital converter) saturates, then an overrange condition occurs and the overange bit for that channel is set.

In a scaling operation, if the result of scaling forces the value to the PLC to exceeed 32767, the overrange bit for that channel is set.

During an overflow condition, the value to the controller defaults to +/– 32767 and there is no rollover of data. That is, the data does not return to zero and beyond.

Alarm Setpoints

Numerical Range All numbers used for alarm setpoints are expressed as signed integers. The numerical range for scaling is +/– 32767. If a value of –32768 is loaded into the module, then the value in the module is adjusted to –32767.

Digital Filtering

Digital filtering time is the settling time to within 1 LSB of the analog-to-digital converter on the module. In a 14-bit system, this can be as long as 40 time constants. (Often digital filtering is specified as a time constant in milliseconds. With a time constant specification, it will take the input 4 to 5 time constants to reach 99% of the final value.) The value entered is the actual settling time.

NOTE: In the PPX:505-2555 module, the value used in digital filtering is not a time constant but is the settling time for the system to reach the full resolution of the analog-to-digital converter (ADC).

When filtering is enabled, the actual resolution of the module is a full 16 bits. The filtering function performs a dithering operation for the least significant bits.

Default Filter Settling Time If the digital filtering bits are enabled via the WY register and the Y32 output and no settling time values are written to the module, then the default digital filter settling time of 250 msec is automatically used.

Filtering and Alarms If filtering is enabled, then the filtered data will be used for alarm comparisons; that is, the data will first pass through the digital filter and its associated settling time and then be compared to any low or high alarm setpoint. This prevents alarm conditions that are attributable to noise.

Changing the Settling Time When new filter data is written to the module, the microcomputer must recompute the filter time constants. This operation takes 25 msec and no new data is written to the controller during this time.

Numerical Range Values loaded into the module for digital filtering are expressed as 16-bit unsigned integers 0 to 65,535 in units of milliseconds.

NOTE: Signed integers will be interpreted as unsigned values.

Averaging

Exclusivity If averaging and filtering are both enabled, alarming is exclusive of averaging. This means that after the data is filtered it is compared against alarm setpoints and then averaged.

Numerical Range Values loaded into the module for averaging are expressed as 16-bit unsigned integers 1 to 65,535 in units of number of samples. Signed integers will be interpreted as unsigned values.

NOTE: A value of zero is ignored and the default value of 20 is used if zero is loaded and enabled.

Averaging Reset Y27 is used to reset all 16 channels to begin the averaging process again. The previously loaded averaging sample number is used (or the default value of 20 if no data is loaded) and the averaging function is enabled.

Averaging Reset with New Value In the event a very large number for averaging is inadvertently loaded into the module and enabled, the input channel will appear to not be working correctly. The input channel requires a reset with a smaller number of samples. To initate a reset with a new averaging value, the number of samples is loaded as previously described and then each channel may be individually reset and enabled for the new value with WY75.

Peak and Valley Hold

Peak or valley hold data is returned in locations WX49 – WX64, provided that Y30 and Y31 are set accordingly. See Figure 3-14.

Data Read	Y30	Y31
Peak	1	1
Valley	0	1
Flags	X	0

Figure 3-14 Peak/Valley Truth Table

NOTE: Upon power up and the enabling of peak and valley hold, peak values returned will be the actual value at the input. Valley values must go below zero, which is the default value before data is returned. This is not the case if a reset is issued to the valley function. On reset the valley threshold is the current value.

Peak and Valley Hold Reset

Outputs Y28 and Y29 are used to reset the valley or peak hold functions. The operation during reset is dependent on whether the hold function is enabled for each individual channel.

Figure 3-15 shows how the peak value and the valley value react during reset.

Peak or Valley Hold Function	
Enabled	Reset to current input value
Disabled	Reset to zero

Figure 3-15 Peak/Valley Reset Truth Table

Flag Bits

When not using peak or valley hold, WX49 – WX54 return flag bits for each of the functions, and each of the channels may be interrogated with ladder logic instructions.

The flag bits correspond to the 16 channels in the module. The LSB or bit 16 corresponds to channel 1, and the MSB or bit 1 corresponds to channel 16. See Figure 3-16.

	MSB															LSB
Bit #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Channel #	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

Figure 3-16 Mapping Bit Position to Channel Number

Alarm flags (WX49) The alarm flag bit is the logical OR of the low alarm bit (WX5) and the high alarm bit (WX50) for each channel. This allows one simple check to determine if an alarm exists on a channel. These alarm bits reset automatically when the alarm condition is no longer true. In the event that an alarm exists on a channel, the ladder logic may determine whether the alarm has reached the low alarm or the high alarm.

Overrange/Underrange flags The overrange (WX52) and underrange (WX53) flag bits are set any time the analog-to-digital converter (ADC) saturates and cannot produce any higher value for positive inputs or lower value for negative inputs.

NOTE: A zero input value is a reasonable input level of signal. It is not uncommon for the input to go below zero and the sign bit to change. The ADC will function below a value of zero until saturation.

Advanced Function Precedence

When using more than one of the advanced functions, it is necessary to understand the order in which these functions are performed in the PPX:505-2555 hardware. The order of precedence for these functions is as follows:

1. Offset mode for 4–20 mA or 1–5 VDC inputs
2. Scaling for low and high engineering units
3. Filtering
4. Alarm processing
5. Peak and Valley hold measurements
6. Averaging

Appendix A

Troubleshooting

A.1 Troubleshooting the Module

If the module provides improper readings or the status indicator is not on, use Table A-1 to determine the appropriate corrective action.

Table A-1 Troubleshooting Matrix

Symptom	Probable Cause	Corrective Action
Indicator not lit	Base or controller power is off	Turn base or controller on
	Defective module	Return the module to Siemens for repair
Blinking indicator	EEPROM failure	Return the module to Siemens for repair
Incorrect inputs	Blown fuse	Return the module to Siemens for repair (see Caution below)
	Wrong addresses for word input	Check program for correct word input addresses
	Not logged in	Read I/O configuration
	Incorrect jumper settings	Refer to Chapter 2 for jumper settings
	Incorrectly calibrated	Return the module to Siemens for recalibration
	Noisy signal	Check for proper shield termination at input connectors

When it is inconvenient to visually check the status indicator, use the TISOFT “Display Failed I/O” or “Show PLC Diagnostics” functions. Note that if the module power supply fails, the module will still be logged into the controller even though it is not operating. In this case, “Display Failed I/O” will not provide the information to accurately diagnose the problem.

CAUTION

The module fuse (F1) is not user servicable. If this fuse is blown, the module has a serious component failure.

Do not attempt to repair or replace fuse (F1). Return the module to your nearest Siemens distributor or Siemens Energy & Automation, Inc. for repair.

If after consulting the chart above, you are unable to diagnose or solve the problem, contact the Siemens Energy & Automation, Inc., Technical Services Group in the U.S.A. at 423–461–2522. In other countries, you can also contact the nearest Siemens distributor.

A.2 Troubleshooting the System

Use the following procedures and Table A-2 to troubleshoot your system.

- First examine your V- or K-memory tables to ensure that the data to be loaded into the module makes sense.
- Utilize the worksheets in Appendices E and F to calculate key address locations.
- Examine the relay ladder program to verify that the V-memory tables are being loaded into the correct WY65 – WY96 output registers.
- Examine the starting address of the module and ensure that the offsets for the X16 input Module_Ready = (starting address + 15) and that the Y outputs = (starting address + 16), that the WX registers = (starting address + 32) and the WY registers = (starting address + 64).
- Examine the relay ladder program to verify that the addresses used match the offsets as described above and those from the worksheets.
- Verify that the data identification outputs Y19 – Y17 properly reference the data that is being loaded.
- Use the TISOFT status and chart functions to debug the program and to verify that the X16 Module_Ready input does indeed turn on. If this input does not turn on, there is a problem with the module. Contact the Siemens Energy & Automation, Inc., Technical Services Group in the U.S.A. at 423–461–2522.
- Verify that the Y32 Data_Ready output does indeed turn on to load the data into the PPX:505-2555 module.
- Place a known input value on the module channel and verify that the channel is producing the correct results.

Table A-2 Troubleshooting Flow Diagram

Symptom	Probable Cause	Corrective Action
Wrong values	Not logged in	Log in to controller
No functions working	Not logged in correctly	Verify log-in
	Ladder program did not execute	Debug ladder program. Verify V-memory tables.
	Offsets incorrect	Calculate offsets starting address
	Functions never enabled	Edit ladder program to enable function after loading data

Appendix B
Specifications

Table B-1 Physical and Environmental Specifications

Input Channels	16 differential input channels (140 VRMS channel-to-channel common mode rejection CMR)
Signal Range	Unipolar: 0 to 5 VDC, 0 to 10 VDC, or 0 to 20 mA Bipolar: –5 to +5 VDC, –10 to +10 VDC, or –20 to +20 mA
Update Time	5.9 ms, no filtering 8.2 ms, digital filtering enabled (See Section 3.4 for update times in enhanced mode)
Digital Filtering Time Constant	25 ms
DC Input Resistance	Voltage Mode: 680 kΩ Current Mode: 250 Ω
Repeatability	0.008%
Accuracy	Voltage Mode 0.10% of full scale at 25°C 0.30% of full scale at 0–60°C Current Mode 0.20% of full scale at 25°C 0.40% of full scale at 0–60°C
Resolution	Unipolar: 14 bit plus sign 0–5 VDC range = 0.3125 mV/step 0–10 VDC range = 0.625 mV/step 0–20 mA range = 1.25 µA/step Bipolar: 13 bit plus sign +5 to –5 VDC = 0.625 mV/step +10 to –10 VDC range = 1.25 mV/step –20 to +20 mA range = 2.5 µA/step
Common Mode Rejection	>86db @ 60Hz (digital filtering disabled)
Normal Mode Rejection	>45db @ 60Hz (digital filtering enabled)
Input Protection	Input ESD Protection: 4,000 V Overrange Protection: 500 V
Isolation	1500 VDC channel-to-PLC
Module Size	Single wide
Backplane Power Consumption	5.0 Watts
Operating Temperature	0° to 60°C (32° to 140°F)
Storage Temperature	–40° to 85°C (–40° to 185°F)
Humidity, Relative	5% to 95% (noncondensing)
Shipping Weight	1.5 lbs (0.68 Kg)
Agency Approvals	UL, UL for Canada, FM (Class I, Div 2), CE

Specifications subject to change without notice.

Appendix C
Jumper Settings Log Sheet

Record the configuration jumper settings on this log for future reference. Make additional copies if necessary.

Table C-1 Jumper Settings Log

Channel Number	Voltage/ Current Jumper		Jumper Position V or I	Voltage Range Jumper	Jumper Position 5 V or 10 V	Unipolar/ Bipolar Jumper	Jumper Position UNI or BIP
1	JP1	1		JP5		JP5	
2		2		JP6		JP6	
3		3		JP7		JP7	
4		4		JP8		JP8	
5	JP2	5		JP9		JP9	
6		6		JP10		JP10	
7		7		JP11		JP11	
8		8		JP12		JP12	
9	JP3	9		JP13		JP13	
10		10		JP14		JP14	
11		11		JP15		JP15	
12		12		JP16		JP16	
13	JP4	13		JP17		JP17	
14		14		JP18		JP18	
15		15		JP19		JP19	
16		16		JP20		JP20	

All Channels	Unipolar/ Bipolar Switches	Voltage Range Switches	Digital Filtering Jumper	Jumper Position FIL/none
1–16	SW7 SW8	SW5 SW6	JP121	FIL

Appendix D
I/O Register Quick Reference

X1 *thru* X15	reserved
X16	Module Ready (505-2555 to controller)

Y17	0	1	0	1	0
Y18	0	0	1	1	0
Y19	0	0	0	0	1
	no operation	function enable	low/high alarm values	low/high scaling values	filtering time constants/number of averages

Y20 *thru* Y26	not used
Y27	Averaging reset (all channels)
Y28	Valley hold reset (all channels)
Y29	Peak hold reset (all channels)
Y30	0=read valley hold values; 1= read peak hold values
Y31	0=read flags; 1=read peak/valley hold values
Y32	Data ready (controller to 505-2555)

WX33 *thru* WX48	Channel 1 conversion data (in engineering units) *thru* Channel 16
WX49	Alarm flag bits
WX50	High alarm flags
WX51	Low alarm flags
WX52	Overrange flags
WX53	Underrange flags
WX54	Overflow flags
WX55 *thru* WX64	reserved

WX49 through WX64 above <– OR –> (ref Y31): WX49 Channel 1 peak/valley hold *thru* WX64 Channel 16

WY65 *thru* WY80	Channel 1 low alarm setpoint (in engineering units) *thru* Channel 16	if Y17=0 Y18=1 Y19=0
WY81 *thru* WY96	Channel 1 high alarm setpoint (in engineering units) *thru* Channel 16	

WY65 *thru* WY80	Channel 1 scaling low setpoint (in engineering units) *thru* Channel 16	if Y17=1 Y18=1 Y19=0
WY81 *thru* WY96	Channel 1 scaling high setpoint (in engineering units) *thru* Channel 16	

WY65 *thru* WY80	Channel 1 filtering time constant (in milliseconds) *thru* Channel 16	if Y17=0 Y18=0 Y19=1
WY81 *thru* WY96	Channel 1 averaging (number of samples) *thru* Channel 16	

WY65	Low alarm enable	(LSB=Ch 1, MSB=Ch 16)	if Y17=1 Y18=0 Y19=0
WY66	High alarm enable	.	
WY67	Scaling enable	.	
WY68	Digital filtering enable	.	
WY69	Averaging enable	.	
WY70	Peak hold enable	.	
WY71	Valley hold enable	.	
WY72	4–20 mA offset mode enable	.	
WY73	Peak hold reset	.	
WY74	Valley hold reset	.	
WY75	Averaging reset with new sample counts	.	
WY76 *thru* WY96	reserved		

Appendix E

V- or K-Memory Configuration Tables

Alarm Setpoints

Table address______________________________

Channel #		**Setpoint**
1 ________________	Low	________________
	High	________________
2 ________________	Low	________________
	High	________________
3 ________________	Low	________________
	High	________________
4 ________________	Low	________________
	High	________________
5 ________________	Low	________________
	High	________________
6 ________________	Low	________________
	High	________________
7 ________________	Low	________________
	High	________________
8 ________________	Low	________________
	High	________________
9 ________________	Low	________________
	High	________________
10 ________________	Low	________________
	High	________________
11 ________________	Low	________________
	High	________________
12 ________________	Low	________________
	High	________________
13 ________________	Low	________________
	High	________________
14 ________________	Low	________________
	High	________________
15 ________________	Low	________________
	High	________________
16 ________________	Low	________________
	High	________________

Scaling Units

Table address______________________________

Channel #		**Units**
1 ________________	Low	________________
	High	________________
2 ________________	Low	________________
	High	________________
3 ________________	Low	________________
	High	________________
4 ________________	Low	________________
	High	________________
5 ________________	Low	________________
	High	________________
6 ________________	Low	________________
	High	________________
7 ________________	Low	________________
	High	________________
8 ________________	Low	________________
	High	________________
9 ________________	Low	________________
	High	________________
10 ________________	Low	________________
	High	________________
11 ________________	Low	________________
	High	________________
12 ________________	Low	________________
	High	________________
13 ________________	Low	________________
	High	________________
14 ________________	Low	________________
	High	________________
15 ________________	Low	________________
	High	________________
16 ________________	Low	________________
	High	________________

Number of Averages

Table address____________________

Channel #		Number of Averages
1	____________	____________
2	____________	____________
3	____________	____________
4	____________	____________
5	____________	____________
6	____________	____________
7	____________	____________
8	____________	____________
9	____________	____________
10	____________	____________
11	____________	____________
12	____________	____________
13	____________	____________
14	____________	____________
15	____________	____________
16	____________	____________

Filtering Settling Time

Table address____________________

Channel #		Settling Time (milliseconds)
1	____________	____________
2	____________	____________
3	____________	____________
4	____________	____________
5	____________	____________
6	____________	____________
7	____________	____________
8	____________	____________
9	____________	____________
10	____________	____________
11	____________	____________
12	____________	____________
13	____________	____________
14	____________	____________
15	____________	____________
16	____________	____________

Function Enable Bits

Start of Enable block WY ____________

	Value
Low alarm	____________
High alarm	____________
Scaling	____________
Digital filtering	____________
Averaging	____________
Peak hold	____________
Valley hold	____________
4-20 mA offset mode	____________

Appendix F

Addressing Worksheet

This worksheet will aid in establishing the correct address for critical locations such as Module_Ready, Data_Ready and locations of the start of the WY register block.

Controller Start Log-in Address (Start)	X ____________
Module_Ready (Start + 15)	X ____________
Data Identification Bits Y17 – Y19 (Start + 16)	Y ____________
Data_Ready (Start + 31)	Y ____________
Averaging Reset (Start + 26)	Y ____________
Peak Hold Reset (Start + 27)	Y ____________
Valley Hold Reset (Start + 28)	Y ____________
Start of WX Registers (Start + 32)	WX____________
Start of WY Registers (Start + 64)	WY____________
Peak/Valley Select Bit (Start + 29)	Y ____________
Flag Bits or Peak/Valley Select (Start + 30)	Y ____________

Figure F-1 Addressing Worksheet

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