

USER MANUAL



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An **Allied Motion** Company

User's Manual Pub. 0300255-02 Rev. A

Micro800™ 4-Channel Universal Analog Module

Catalog Number: 2080sc-IF4U



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Important Notes

1. Please read all the information in this owner's guide before installing the product.
2. The information in this owner's guide applies to hardware Series A and firmware version 1.1 or later.
3. This guide assumes that the reader has a full working knowledge of the relevant processor.

Notice

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Preface

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

- Who should use this manual
- How to use this manual
- Rockwell Automation technical support
- Documentation
- Conventions used in this manual

Who Should Use This Manual

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use Allen-Bradley I/O and/or compatible controllers, such as CompactLogix and ControlLogix.

How to Use This Manual

As much as possible, we organized this manual to explain, in a task-by-task manner, how to install, configure, program, operate, and troubleshoot a control system using the Micro800™ 2080sc-IF4U 4-Channel Universal Analog Module.

Rockwell Automation Technical Support

For technical support, please contact your local Rockwell Automation TechConnect Office for all Spectrum products. Contact numbers are as follows:

- USA 1-440-646-6900
- United Kingdom 01-908-635-230
- Australia 1-800-809-929
- Mexico 001-888-365-8677
- Brazil 55-11-3618-8800
- Europe +49-211-41553-630

or send an email to support@spectrumcontrols.com




Documentation

If you would like a .PDF version of a manual, you can download a free electronic version at www.spectrumcontrols.com

Conventions Used in This Manual

The following conventions are used throughout this manual:

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

<p>WARNING</p> 	<p>Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you to identify a hazard, avoid a hazard, and recognize the consequences.</p>
<p>ATTENTION</p> 	<p>Actions ou situations risquant d'entraîner des blessures pouvant être mortelles, des dégâts matériels ou des pertes financières. Les messages « Attention » vous aident à identifier un danger, à éviter ce danger et en discerner les conséquences.</p>
<p>NOTE</p> 	<p>Identifies information that is critical for successful application and understanding of the product.</p>

Chapter 1

Module Overview

Section 1.1 General Description

The 2080sc-IF4UV2 Universal Analog Input Module is a four-point universal analog input module for use with Rockwell Automation Micro800™ systems. This module measures analog inputs on up to four concurrent channels of current, voltage and thermocouples and/or up to two channels of 4-wire RTD and resistance measurements. The 2080sc-IF4UV2 module uses a 20-bit Sigma-Delta analog-to-digital converter to achieve 16-bit resolution. All inputs have fault tolerance and ESD protection to avoid damage to circuitry on the board.

The module plugs into any spare plug-in slot on the PLC. A 40-pin connector provides the connection between the controller and the module. The module interfaces with the controller via an Asynchronous Parallel Interface (API). The module shares this parallel bus with other peripherals in the controller.

The exchange of data between the module and controller is used to communicate module configuration, status and digitized samples from the four analog inputs. Other types of exchanges also occur across the API. These exchanges include reset commands by the controller, interrupts from the module to the controller, module status queries by the controller, configuration changes and other associated communications.

Power is provided across the backplane connector used to implement the API. Analog input signals are connected to the module via a 12-pin terminal block on the module.

The module provides the following functions:

- Use any combination of input types at one time.
- Is individually programmable for each channel.
- Is easy to configure using CCW programming software.
- Has channel-selectable filtering for fastest analog update time and noise rejection.
- Has cold junction compensation included for thermocouples.
- Has accuracy comparable with dedicated analog modules.
- Provides 3-wire support for RTDs.

The I/O module operates in normal run mode when installed in a Micro800 controller chassis and is powered on. The I/O module is designed to operate 24 hours a day 7 days a week for a period of years with only periodic shutdowns for maintenance.

The unit may be operated attended or unattended.



Section 1.2 Environment and Enclosure

WARNING



This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC publication 60664-1), at altitudes up to 2000 meters (6562 feet) without derating.


This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR Publication 11. Without appropriate precautions, there may be potential difficulties ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbance.

This equipment is supplied as open-type equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5 VA, V2, V1, V0 (or equivalent) if non-metallic. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.


In addition to this publication, see:


- Industrial Automation Wiring and Grounding Guidelines, Allen-Bradley publication 1770-4.1, for additional installation requirements.

NEMA Standards publication 250 and IEC publication 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure.

<p>WARNING</p> 	<p>Cet équipement est prévu pour fonctionner en environnement industriel avec une pollution de niveau 2, dans des applications de surtension de catégorie II (telles que définies dans la publication 60664-1 de la CEI) et à une altitude maximum de 2000 m sans déclassement.</p> <p>Cet équipement est considéré comme étant un équipement industriel du Groupe 1, classe A selon CEI/CISPR 11. En l'absence de précautions appropriées, des problèmes de compatibilité électromagnétique peuvent survenir dans des environnements résidentiels et dans d'autres environnement en raison de perturbations conduites et rayonnées.</p> <p>Cet équipement est fourni en tant qu'équipement de type « ouvert ». Il doit être installé à l'intérieur d'une armoire fournissant une protection adaptée aux conditions d'utilisation ambiantes et suffisante pour éviter toute blessure pouvant résulter d'un contact direct avec des composants sous tension.</p> <p>L'armoire doit posséder des propriétés ignifuges capables d'empêcher ou de limiter la propagation des flammes, correspondant à un indice de propagation de 5VA, V2, V1, V0 (ou équivalent) dans le cas d'une armoire non métallique.</p> <p>L'accès à l'intérieur de l'armoire ne doit être possible qu'à l'aide d'un outil. Cette armoire doit permettre des connexions d'alimentation par un système de câblage de Classe I, Division 2, conformément au code électrique national (NEC). Certaines sections de la présente publication peuvent comporter des recommandations supplémentaires portant sur les indices de protection spécifiques à respecter pour maintenir la conformité à certaines normes de sécurité.</p> <p>En plus de cette publication, consultez:</p> <ul style="list-style-type: none">• La publication Rockwell Automation 1770-4.1, « Industrial Automation Wiring and Grounding Guidelines », pour d'autres critères d'installation.• La publication 250 de la norme NEMA ou la publication 60529 de la CEI, selon le cas, pour obtenir une description des indices de protection que fournissent les différents types d'armoires.
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Section 1.3 Prevent Electrostatic Discharge


<p>WARNING</p> 	<p>Electrostatic discharge can damage integrated circuits or semiconductors if you touch bus connector pins. Follow these guidelines when you handle the module:</p> <ul style="list-style-type: none"> • Touch a grounded object to discharge static potential. • Wear an approved wrist-strap grounding device. • Do not touch connectors or pins on component boards. • Do not touch circuit components inside the module. • If available, use a static-safe workstation. <p>When not in use, keep the module in its static-shield box.</p>
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<p>WARNING</p> 	<p>Cet équipement est sensible aux décharges électrostatiques, lesquelles peuvent entraîner des dommages internes et nuire à son bon fonctionnement.</p> <p>Conformez-vous aux directives suivantes lorsque vous manipulez cet équipement:</p> <ul style="list-style-type: none"> • Touchez un objet mis à la terre pour vous décharger de toute électricité statique éventuelle. • Portez au poignet un bracelet antistatique agréé. • Ne touchez pas les connecteurs ni les broches figurant sur les cartes des composants. • Ne touchez pas les circuits internes de l'équipement. • Utilisez si possible un poste de travail antistatique. <p>Lorsque vous n'utilisez pas l'équipement, stockez-le dans un emballage antistatique.</p>
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Section 1.4 Parts List

Your package contains one Micro800 Universal Analog Input Plug-in Module, installation screws, and one Quick Start Guide.

You can choose to wire the plug-in before inserting it into the controller or wire it once the module is secured in place.

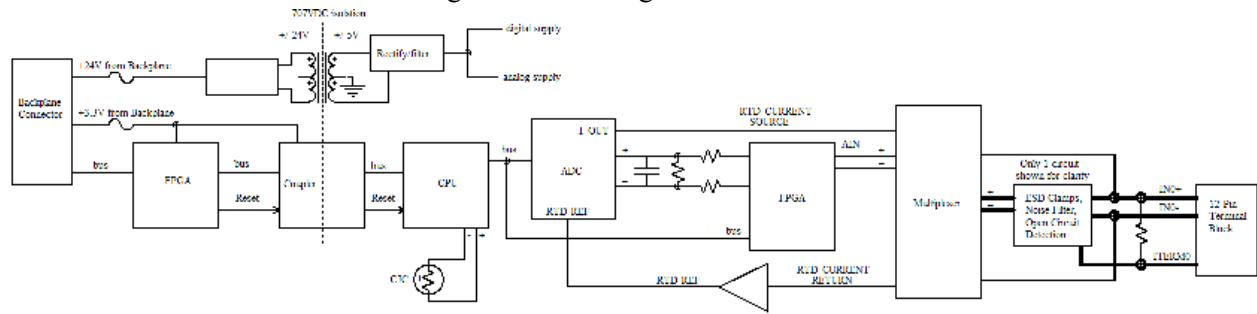
<p>WARNING</p> 	<ul style="list-style-type: none"> • This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR 11. Without appropriate precautions, there may be difficulties with electromagnetic compatibility in residential and other environments due to conducted and radiated disturbance. • Be careful when stripping wires. Wire fragments that fall into the controller could cause damage. Once wiring is complete, make sure the controller is free of all metal fragments before removing the protective debris strip. • Do not wire more than 2 conductors on any single terminal. • If you insert or remove the plug-in module while power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding. • Do not insert or remove the plug-in module while power is applied; otherwise, permanent damage to equipment may occur.
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<p>WARNING</p> 	<ul style="list-style-type: none"> • Cet équipement est considéré comme étant un équipement industriel du Groupe 1, classe A selon CEI/CISPR 11. En l'absence de précautions appropriées, des problèmes de compatibilité électromagnétique peuvent survenir dans des environnements résidentiels et dans d'autres environnements en raison de perturbations conduites et rayonnées. • Soyez vigilant en dénudant les fils. Tout fragment de fil tombé dans l'automate risquerait de le détériorer. Une fois le câblage terminé, veillez à ce que l'automate ne présente aucun copeau de métal avant de retirer la bande de protection. • Ne câblez pas plus de 2 conducteurs sur une même borne. • L'insertion ou le retrait du module enfichable sous tension peut provoquer un arc électrique, susceptible de provoquer une explosion dans un environnement dangereux. Assurez-vous que l'alimentation est coupée ou que l'environnement est classé non dangereux avant de poursuivre. • N'insérez pas et ne retirez pas le module enfichable quand l'équipement est sous tension, au risque de provoquer des dommages irrémediables à l'équipement.
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Section 1.5 Hardware Features

The module plugs into, and communicates with, a controller in the Micro800 family. The only exchange of data between the controller and the Plug-In Module is through the API. The Plug-In Module shares the parallel bus with other peripherals in the controller.

The block diagram for the Plug-In Module interface is shown below:



Section 1.6 Module Power Specifications

The controller provides two Power Supplies to the module:

- 3.3 Volts (3.0 V Min, 3.6 V Max), Current Rating: 30 mA
- 24 Volts (20.4 V Min, 26.4 V Max), Current Rating: 30 mA

You may not use an external power source to power the module. Refer to the specifications in the Appendix for further information.

Section 1.7 Module Chassis Earth Ground


The Micro800 controller does not have a chassis (earth) ground. If a chassis (earth) ground connection is needed for a Plug-In Module or devices connected to a Plug-In Module, it must be provided externally. A capacitive coupling between chassis (earth) ground and Plug-In module signal ground is acceptable if required. The capacitor must be rated for least 500 VAC (707 VDC). The IF4UV2 module does not use a chassis ground since it is not available on the backplane or the terminal block.


Chapter 2

Installation and Wiring

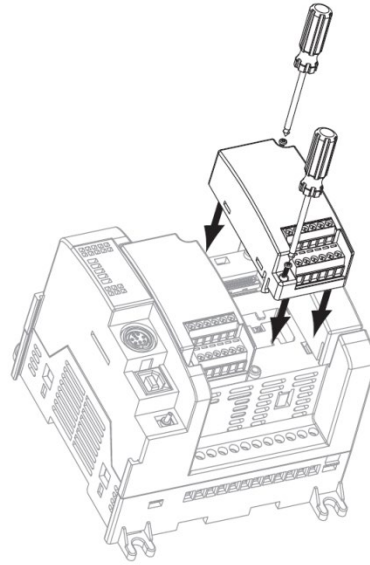
Section 2.1 Insert Module into Controller

Follow the instructions to insert and secure the plug-in module to the controller.

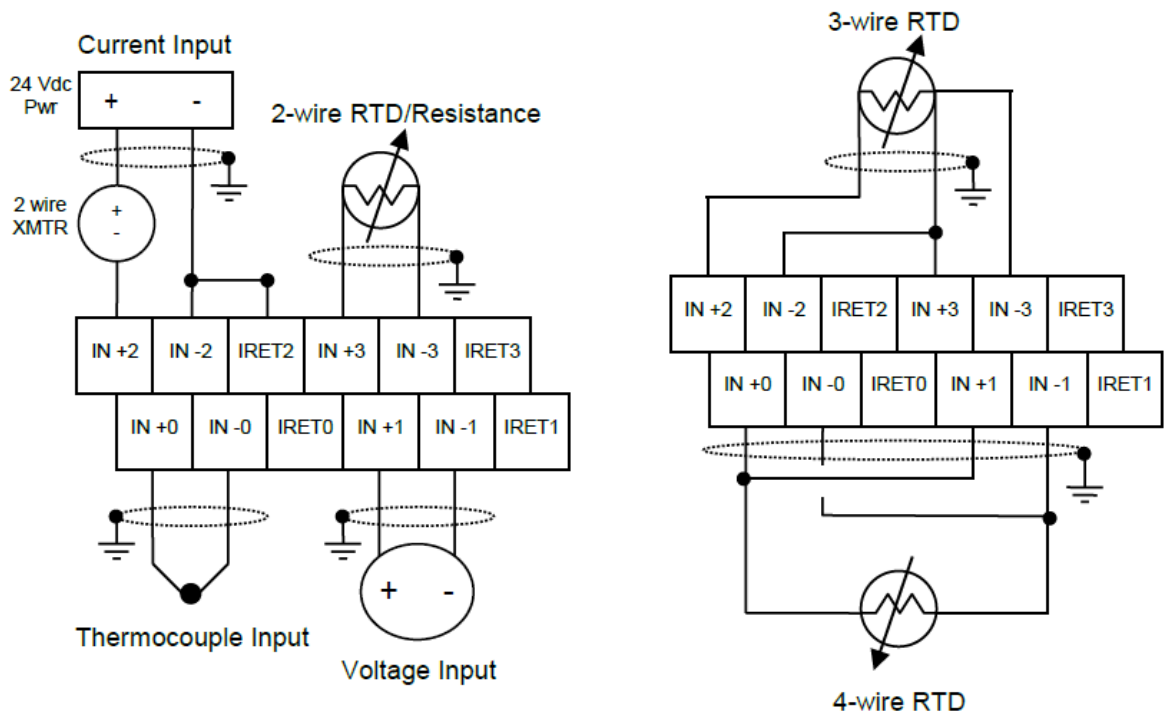
<p>WARNING</p> 	<p>Electrostatic discharge can damage integrated circuits or semiconductors if you touch bus connector pins. Follow these guidelines when you handle the module:</p> <ul style="list-style-type: none">• Touch a grounded object to discharge static potential.• Wear an approved wrist-strap grounding device.• Do not touch connectors or pins on component boards.• Do not touch circuit components inside the module.• If available, use a static-safe workstation.• When not in use, keep the module in its static-shield box.
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<p>WARNING</p> 	<p>Cet équipement est sensible aux décharges électrostatiques, lesquelles peuvent entraîner des dommages internes et nuire à son bon fonctionnement.</p> <p>Conformez-vous aux directives suivantes lorsque vous manipulez cet équipement:</p> <ul style="list-style-type: none">• Touchez un objet mis à la terre pour vous décharger de toute électricité statique éventuelle.• Portez au poignet un bracelet antistatique agréé.• Ne touchez pas les connecteurs ni les broches figurant sur les cartes des composants.• Ne touchez pas les circuits internes de l'équipement.• Utilisez si possible un poste de travail antistatique.• Lorsque vous n'utilisez pas l'équipement, stockez-le dans un emballage antistatique.
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4. Position the plug-in module with the terminal block facing the front of the controller as shown:



5. Snap the module into the module bay.
6. Using a screwdriver, tighten the supplied, self-tapping screw to torque specifications.
7. Follow the wiring diagrams below to wire the module:



**Section 2.2
Configuring
the Module**

The 2080sc-IF4U is configured using 8 SINT configuration registers. The following table describes the module configuration registers:

		Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
			MSB								LSB							
			7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Ch0 Config. 2× Bytes	Channel Enable	Enable Disable																0 1
	Filter Frequency	17 Hz 4 Hz 60 Hz 240 Hz 470 Hz												0 0 0 0 1	0 0 1 1 0	0 1 1 1 0		
Input Type	4-20 mA										0	0	0	0				
	0-20 mA										0	0	0	1				
	±10 V										0	0	1	0				
	0-10 V										0	0	1	1				
	0-5 V										0	1	0	0				
	±100 mV										0	1	0	1				
	±50 mV										0	1	1	0				
	Type J TC										0	1	1	1				
	Type K TC										1	0	0	0				
	Type T TC										1	0	0	1				
	Type E TC										1	0	1	0				
	100 Pt 385										1	0	1	1				
	1000 Pt 385										1	1	0	0				
	100 Pt 3916										1	1	0	1				
	1000 Pt 3916										1	1	1	0				
0-3000 Ohms										1	1	1	1					
Type R TC ¹										1	0	0	0	0				
Undefined Bits									×	×								

		Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
			MSB							LSB									
			7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	
	Data Format ¹	Engr. ×1 Engr. ×10					0 0	0 1											
	Temp. Units	Degrees C Degrees F				0 1													
	2/3/4 Wire RTD, ignored for R ranges.	3-Wire (Default) 4-wire with lead 2-wire		0 0 1	0 1 0														
	CJC Enable	Enable Disable	0 1																
Ch1 Config. 2× Bytes	Data structure the same as channel 0 above																		
Ch2 Config. 2× Bytes	Data structure the same as channel 0 above																		
Ch3 Config. 2× Bytes	Data structure the same as channel 0 above																		

Table 2-2. Data Format

Input Type	Input Value	Condition	EU ×1	EU ×10
E Thermocouple	1000.00 °C	High Range	10000	1000
	-270.00 °C	Low Range	-2700	-270
J Thermocouple	1200.00 °C	High Range	12000	1200
	-210.00 °C	Low Range	-2100	-210
K Thermocouple	1370.00 °C	High Range	13700	1370
	-270.00 °C	Low Range	-2700	-270
T Thermocouple	400.00 °C	High Range	4000	400
	-270.00 °C	Low Range	-2700	-270
R Thermocouple	1768.00 °C	High Range	17680	1768
	0.00 °C	Low Range	0	0
100 Ω Pt 0.385	850.00 °C	High Range	8500	850

¹ Type R thermocouple is only available on modules running firmware version 1.3 or higher. See Table 2-2. Data Format.

Input Type	Input Value	Condition	EU ×1	EU ×10
	-200.00 °C	Low Range	-2000	-200
1000 Ω Pt 0.385	850.00 °C	High Range	8500	850
	-200.00 °C	Low Range	-2000	-200
100 Ω Pt 0.392	630.00 °C	High Range	6300	630
	-200.00 °C	Low Range	-2000	-200
1000 Ω Pt 0.392	630.00 °C	High Range	6300	630
	-200.00 °C	Low Range	-2000	-200
0..3000 Ω	3000.00 ohms	High Range	30000	3000
	0.00 ohms	Low Range	0	0
±50 mV	50.00 mVDC	High Range	5000	500
	-50.00 mVDC	Low Range	-5000	-500
±100 mV	100.00 mVDC	High Range	10000	1000
	-100.00 mVDC	Low Range	-10000	-1000
0..5 V	5.00 VDC	High Range	5000	500
	0.00 VDC	Low Range	0	0
±10 V	10.00 VDC	High Range	10000	1000
	-10.00 VDC	Low Range	-10000	-1000
0..10 V	10.00 VDC	High Range	10000	1000
	0.00 VDC	Low Range	0	0
4..20 mA	20.00 mA	High Range	20000	2000
	4.00 mA	Low Range	4000	400
0..20 mA	20.00 mA	High Range	20000	2000
	0.00 mA	Low Range	0	0
CJC	85.00 °C	High Range	850	85
	-25.00 °C	Low Range	-250	-25

Section 2.3 Module Input Data

There are four input registers used to report data values for each of the four channels and one register to report CJC sensor temperature.

Table 2-3. Module Input Data

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Ch0	Channel 0 Input Data															
Ch1	Channel 1 Input Data															
Ch2	Channel 2 Input Data															
Ch3	Channel 3 Input Data															

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CJC	CJC Temperature in degrees C															

There are four input registers used to report data values for each of the four channels and one register to report CJC sensor temperature.

Table 2-4. Open-Circuit Status

Bit	7	6	5	4	3	2	1	0
	NU	NU	O_CJC	U_CJC	OC3	OC2	OC1	OC0

Bit 0 for channel 0 open wire.

Bit 1 for channel 1 open wire.

Bit 2 for channel 2 open wire.

Bit 3 for channel 3 open wire.

Bit 4 is for CJC under range indication.

Bit 5 is for CJC over range indication.

Bit 6 and Bit 7 are not used.

Table 2-5. Under/Over Range Status

Bit	7	6	5	4	3	2	1	0
	O3	O2	O1	O0	U3	U2	U1	U0

Bit 0 is for channel 0 under range indication.

Bit 1 is for channel 1 under range indication.

Bit 2 is for channel 2 under range indication.

Bit 3 is for channel 3 under range indication.

Bit 4 is for channel 0 over range indication.

Bit 5 is for channel 1 over range indication.

Bit 6 is for channel 2 over range indication.

Bit 7 is for channel 3 over range indication.

Table 2-6. General Module Status

Bit Number	Description	Notes
0-1	These 2 bits define module operation mode, 0: Idle: Module is ready to RUN, and I/O is off. 1: RUN: Module is under RUN, and I/O is on. 2: Error: Error happens, and I/O is off. 3: Busy: Module is busy, cannot go to RUN, and I/O is off.	
2	This bit defines module user interrupt mode, 0: User Interrupt is disabled. 1: User Interrupt is enabled.	The IF4U does not support this functionality; this bit is always off (0).

Bit Number	Description	Notes
3	Reserved	
4	SW Error	Trigger condition – Watchdog timer triggered.
5	ADC Error	Trigger condition – ADC communication stops or ADC has not sampled data for long period of time.
6	Calibration Error	Trigger condition – blank calibration or calibration checksum error.
7	Configuration Error	Wrong bits set in channel configuration.

Section 2.4

Add the IF4U to CCW

The 2080sc-IF4U is configured for CCW (Connected Components Workbench) using the PLUGIN_READ and PLUGIN_WRITE instructions for generic plug-in modules.

The configuration, input data, and status structures discussed in the sections above, are stored at different memory locations in the module. The following table lists the memory location offset for each parameter which is used when configuring the PLUGIN_READ, WRITE, and INFO instructions.

Table 2-7. Parameter Offset

Parameter	Offset (Dec)	Comments
MOD_ID_LO	0	Module ID
MOD_ID_HI	1	
VENDOR_ID_LO	2	Vendor ID
VENDOR_ID_HI	3	
PRODUCT_TYPE_LO	4	
PRODUCT_TYPE_HI	5	
PRODUCT_CODE_LO	6	
PRODUCT_CODE_HI	7	
MOD_REV_LO	8	Minor revision, 1-255
MOD_REV_HI	9	Major revision, 1-127
MOD_STATUS	16	Module status register (see Table 6)

Parameter	Offset (Dec)	Comments
SYNC_DATA_LATCH	26	Writing 0xA5 to this register triggers input data latch
CONFIG_IN0_LO	32	Channel Configuration Registers
CONFIG_IN0_HI	33	
CONFIG_IN1_LO	34	
CONFIG_IN1_HI	35	
CONFIG_IN2_LO	36	
CONFIG_IN2_HI	37	
CONFIG_IN3_LO	38	
CONFIG_IN3_HI	39	
INPUT_DATA_0_LO	48	Input Data (Format is 16-bit signed integer)
INPUT_DATA_0_HI	49	
INPUT_DATA_1_LO	50	
INPUT_DATA_1_HI	51	
INPUT_DATA_2_LO	52	
INPUT_DATA_2_HI	53	
INPUT_DATA_3_LO	54	
INPUT_DATA_3_HI	55	
CJC_DATA_LO	56	
CJC_DATA_HI	57	
OC_STATUS	80	Open-circuit status
U_O_RANGE_STATUS	81	Under/over range status

The following sample program, written in structured text, demonstrates how to configure the module in CCW:

```

u800Slot := 3;          (* Slot number 3 for IF4U module. *)
ConfigArray[1] := 112; (*Ch0 Config LSB 112d for Type J TC *)
ConfigArray[2] := 0;   (*Ch0 Config MSB *)
ConfigArray[3] := 16;  (*Ch1 Config LSB 16d for 0-20mA *)
ConfigArray[4] := 0;   (*Ch1 Config MSB *)
ConfigArray[5] := 48;  (*Ch2 Config LSB 48d for 0-10Vdc *)
ConfigArray[6] := 0;   (*Ch2 Config MSB *)
ConfigArray[7] := 240; (*Ch3 Config LSB =240d for 0-3000 ohm X10 *)
ConfigArray[8] := 0;   (*Ch3 Config MSB =0d for resistance *)

WriteConfig(true,u800Slot,32,8,ConfigArray);          (* Write
the config. data to the module*)
ReadModStatus(true,u800Slot,16,1,IF4U_Slot3_ModStatus); (* Read

```

```

general module status *)
ReadOCStatus(true,u800Slot,80,1,IF4U_Slot3_OCStatus);    (* Read
open-circuit status *)
ReadUOStatus(true,u800Slot,81,1,IF4U_Slot3_OUStatus);    (* Read
under/overrange status *)
WriteSyncData(true,u800Slot,26,1,SyncDataArray);        (* Write
sync data command (A5 Hex) to the module *)
ReadModData(true,u800Slot,48,10,Inp_DataTbl);           (* Read
the input data from the module. *)

x := 9;          CHData := 0;
                (* Preset the for loop exit value and channel data.
*)
for i := 1 to x by 2 do
                (* For Loop. *)
    CHData := (any_to_int(Inp_DataTbl[i+1])*256 +
any_to_int(Inp_DataTbl[i]));    (* Convert SINT data to INT
data*)
    case i of (* Put the data into their corresponding global
variables. *)
        1: IF4U_Slot3_IN_0 := CHData;
        3: IF4U_Slot3_IN_1 := CHData;
        5: IF4U_Slot3_IN_2 := CHData;
        7: IF4U_Slot3_IN_3 := CHData;
        9: IF4U_Slot3_IN_CJC := CHData;
    end_case;
    CHData := 0;
end_for;

(*****
(* Humidity & Cylinder Data
*)
(*****

Cylinder_Temp := ANY_TO_REAL(IF4U_Slot3_IN_0);
Cylinder_Temp := Cylinder_Temp/10.0;
Cylinder_CMD_Feedback := ANY_TO_REAL(IF4U_Slot3_IN_1);
Cylinder_CMD_Feedback := Cylinder_CMD_Feedback/10.0;
Humidity_Ambient := ANY_TO_REAL(IF4U_Slot3_IN_2);
Humidity_Ambient := Humidity_Ambient/250.0;
Cylinder_Position := ANY_TO_REAL(IF4U_Slot3_IN_3);
Cylinder_Position := Cylinder_Position/10.0;
CJC_Temp := ANY_TO_REAL(IF4U_Slot3_IN_CJC);
CJC_Temp := CJC_Temp/10.0;

(*****
(* Channel Status
*)
(*****

IF4U_Slot3_OC_Ch0 := IF4U_Slot3_OCStatus[1].0;
IF4U_Slot3_OC_Ch1 := IF4U_Slot3_OCStatus[1].1;
IF4U_Slot3_OC_Ch2 := IF4U_Slot3_OCStatus[1].2;
IF4U_Slot3_OC_Ch3 := IF4U_Slot3_OCStatus[1].3;
IF4U_Slot3_UR_CJC := IF4U_Slot3_OCStatus[1].4;

```

```

IF4U_Slot3_OR_CJC := IF4U_Slot3_OCStatus[1].5;

IF4U_Slot3_UR_Ch0 := IF4U_Slot3_OUStatus[1].0;
IF4U_Slot3_UR_Ch1 := IF4U_Slot3_OUStatus[1].1;
IF4U_Slot3_UR_Ch2 := IF4U_Slot3_OUStatus[1].2;
IF4U_Slot3_UR_Ch3 := IF4U_Slot3_OUStatus[1].3;

IF4U_Slot3_OR_Ch0 := IF4U_Slot3_OUStatus[1].4;
IF4U_Slot3_OR_Ch1 := IF4U_Slot3_OUStatus[1].5;
IF4U_Slot3_OR_Ch2 := IF4U_Slot3_OUStatus[1].6;
IF4U_Slot3_OR_Ch3 := IF4U_Slot3_OUStatus[1].7;

(*
General Module Status, Bits Number 0 & 1 Description

These 2 bits define module operation mode,
0: IDLE: Module is ready to RUN, and I/O is off.
1: RUN: Module is under RUN, and I/O is on.
2: ERROR: Error happens, and I/O is off.
3: BUSY: Module is busy, cannot go to RUN, and I/O is off.
*)

(* Mask off First 2 bits *)
IF4U_Slot3_Module_Status.0 := IF4U_Slot3_ModStatus[1].0;
IF4U_Slot3_Module_Status.1 := IF4U_Slot3_ModStatus[1].1;

IF IF4U_Slot3_Module_Status = 0 THEN
    IF4U_Slot3_Status_IDLE := TRUE;
ELSE
    IF4U_Slot3_Status_IDLE := FALSE;
END_IF;

IF IF4U_Slot3_Module_Status = 1 THEN
    IF4U_Slot3_Status_RUN := TRUE;
ELSE
    IF4U_Slot3_Status_RUN := FALSE;
END_IF;

IF IF4U_Slot3_Module_Status = 2 THEN
    IF4U_Slot3_Status_ERROR := TRUE;
ELSE
    IF4U_Slot3_Status_ERROR := FALSE;
END_IF;

IF IF4U_Slot3_Module_Status = 3 THEN
    IF4U_Slot3_Status_BUSY := TRUE;
ELSE
    IF4U_Slot3_Status_BUSY := FALSE;
END_IF;

IF4U_Slot3_Status_ERROR_SW := IF4U_Slot3_ModStatus[1].4;

```

```
IF4U_Slot3_Status_ERROR_ADC := IF4U_Slot3_ModStatus[1].5;  
IF4U_Slot3_Status_ERROR_CAL := IF4U_Slot3_ModStatus[1].6;  
IF4U_Slot3_Status_ERROR_CONFIG := IF4U_Slot3_ModStatus[1].7;
```

The sample project above can be downloaded from our website at www.spectrumcontrols.com.

Section 2.5 Technical Assistance

Note that your module contains electrostatic components that are susceptible to damage from electrostatic discharge (ESD). An electrostatic charge can accumulate on the surface of ordinary wrapping or cushioning material. **In the unlikely event that the module should need to be returned to Spectrum Controls, Inc., please ensure that the unit is enclosed in approved ESD packaging (such as static-shielding/metallized bag or black conductive container).** Spectrum Controls, Inc. reserves the right to void the warranty on any unit that is improperly packaged for shipment.

For further information or assistance, please contact your local distributor, or call the technical support number provided under the Technical Support section in the Preface.

Appendix A Configuration Information

This appendix contains configuration information as follows:

Input Specifications

Input Specification	Description
Inputs per module	<ul style="list-style-type: none"> • 4 current, voltage, thermocouple input channels OR • 2 plus 1 to 2 resistance/RTD channel OR • 2 to 4 resistance/RTD channels
Input ranges	<ul style="list-style-type: none"> • 0-20 mA • 4-20 mA • ± 50 mV • ± 100 mV • 0-5 V • 0-10 V • ± 10 V • Types J, K, T, E thermocouple, • 100 Ω and 1000 Ω PT385 and Pt3916 resistance • 3000 Ω resistance.
Thermocouple Accuracy	<p>Linearization per ITS-90</p> <p>System accuracy at 25 °C (4 and 17 Hz filters)</p> <p>Type J (-180 °C to 1200 °C) ± 1 °C maximum</p> <p>Type J (-210 °C to -180 °C) ± 1.4 °C maximum</p> <p>Type K (-200 °C to 1370 °C) ± 1 °C maximum</p> <p>Type K (-270 °C to -200 °C) ± 10 °C maximum</p> <p>Type T (-190 °C to 400 °C) ± 1.5 °C maximum</p> <p>Type T (-270 °C to -190 °C) ± 10 °C maximum</p> <p>Type E (-200 °C to 1000 °C) ± 1 °C maximum</p> <p>Type E (-270 °C to -200 °C) ± 8 °C maximum</p> <p>Type R (300 °C to 1768 °C) ± 4 °C maximum</p> <p>Type R (0 °C to 300 °C) ± 8 °C maximum</p> <p>System accuracy at -20 °C to 65 °C (4 and 17 Hz filters)</p> <p>Type J (-180 °C to 1200 °C) ± 2 °C maximum</p> <p>Type J (-210 °C to -180 °C) ± 2.8 °C maximum</p> <p>Type K (-200 °C to 1370 °C) ± 2 °C maximum</p> <p>Type K (-270 °C to -200 °C) ± 20 °C maximum</p>

Input Specification	Description
	Type T (-190 °C to 400 °C) ± 3 °C maximum Type T (-270 °C to -190 °C) ± 20 °C maximum Type E (-200 °C to 1000 °C) ± 2 °C maximum Type E (-270 °C to -200 °C) ± 16 °C maximum Type R (300 °C to 1768 °C) ± 6 °C maximum Type R (0 °C to 300 °C) ± 12 °C maximum
CJC accuracy	± 3 °C maximum
CJC Sensor resolution	± 0.4 °C maximum
CJC Sensor accuracy	± 1.5 °C maximum
Voltage Accuracy	System accuracy at 25 °C (4 and 17 Hz filters) ± 40 μ V maximum for ± 50 mV inputs ± 40 μ V maximum for ± 100 mV inputs ± 6 mV maximum for 0-5 V inputs ± 20 mV maximum for 0-10 V inputs ± 20 mV maximum for ± 10 V inputs System accuracy at -20-65 °C (4 and 17 Hz filters) ± 80 μ V maximum for ± 50 mV inputs ± 80 μ V maximum for ± 100 mV inputs ± 12 mV maximum for 0-5 V inputs ± 40 mV maximum for 0-10 V inputs ± 40 mV maximum for ± 10 V inputs
Current Accuracy	System accuracy at 25 °C (4 and 17 Hz filters) ± 50 μ A maximum for 0-20 mA inputs ± 50 μ A maximum for 4-20 mA inputs System accuracy at -20-65 °C (4 and 17 Hz filters) ± 120 μ A maximum for 0-20 mA inputs ± 120 μ A maximum for 4-20 mA inputs
RTD Accuracy	System accuracy at 25 °C (4 and 17 Hz filters) ± 0.7 °C for 1000 Ω Platinum 385 and 3916 ± 3.1 °C for 100 Ω Platinum 3916 ± 3.4 °C for 100 Ω Platinum 385 System accuracy at -20-65 °C (4 and 17 Hz filters) ± 1.2 °C for 1000 Ω Platinum 385 and 3916 ± 4.7 °C for 100 Ω Platinum 3916 ± 5.1 °C for 100 Ω Platinum 385
Resistance Accuracy	System accuracy at 25 °C (4 and 17 Hz filters) ± 1.5 Ω for 3000 Ω range System accuracy at -20-65 °C (4 and 17 Hz filters) ± 2.5 Ω for 3000 Ω range

Input Specification		Description	
Repeatability (at 25 °C)	4 Hz filter	17 Hz filter	60, 240 and 470 Hz filters
Type J	±0.2 °C	±0.4 °C	±1 °C
Type K (-200 °C to 1370 °C)	±0.2 °C	±0.4 °C	±2 °C
Type K (-270 °C to -200 °C)	±2 °C	±3.5 °C	±10 °C
Type T (-190 °C to 400 °C)	±0.2 °C	±0.4 °C	±2 °C
Type T (-270 °C to -190 °C)	±1 °C	±1.5 °C	±8 °C
Type E (-200 °C to 1000 °C)	±0.2 °C	±0.4 °C	±2 °C
Type E (-270 °C to -200 °C)	±1 °C	±1.5 °C	±8 °C
Type R (300 °C to 1768 °C)	±2 °C	±2.2 °C	±4 °C
Type R (0 °C to 300 °C)	±4 °C	±4.4 °C	±8 °C
±50 mV, ±100 mV	±20 µV	±22 µV	±40 µV
0-5 V, 0-10 V, ±10 V	±1.5 mV	±1.8 mV	±6 mV
0-20 mA, 4-20 mA	±3 µA	±4 µA	±15 µA
RTD, Platinum 385, 3916	±0.3 °C	±0.4 °C	±2 °C
Resistance	±0.2 Ω	±0.3 Ω	±2 Ω
CMRR	84 dB minimum at 50 and 60 Hz for 4 Hz and 17 Hz filters		
NMRR	4 Hz filter	72 dB minimum at 50 and 60 Hz	
	17 Hz filter	62 dB minimum at 50 and 60 Hz	
Crosstalk	-70 dB maximum		
Cable resistance (applies only to 3- and 4-wire RTD and resistance measurements)	25 Ω maximum		
Input bias current	Less than ±2.5 µA steady state for ±10 V inputs, less than 1.75 µA for all other voltage and TC inputs. Less than ±40 µA peak for all voltage and TC input configurations.		
Current input impedance	249 Ω ±0.1%, 10 PPM/°C		

Input Specification	Description
Input protection	Voltage Mode ± 30 VDC continuous. Current Mode 28 mA continuous.
Power source	3.3 VDC and 24 VDC from backplane, 30 mA max from each
Electrical Isolation (continuous)	50 V RMS
Channel-to-Channel Isolation	None
Power consumption	<22 mA at 3.3 V, <18 mA at 24 V, <1.5 W
Inrush current	<120 mA at 3.3 V, <120 mA at 24 V
Fusing	2.7 Ω 1/10 W resistor on 24 VDC input, 0.47 Ω 1/10 W resistor on 3.3 VDC input
Fault detection	Over/under range for all types, open circuit in voltage, RTD, resistance ranges shown as over-range
Input filters	4 Hz, 17 Hz, 60 Hz, 470 Hz
Wire size	#16 to #30 AWG
Operating temperature	-20 °C to 65 °C
Storage temperature	-45 °C to 85 °C
Operating humidity	5% to 95% (non-condensing)
Agency approvals / evaluations	UL/cUL 508 ANSI/ISA 12.12.01 (Class I, Div 2, T4A)
Manufacturing	RoHS and REACH compliant
Dimensions	58.4 mm \times 29.3 mm \times 25 mm

Environmental Specifications

Environmental Tests	Industry Standards	Test Level Limits
Temperature (Operating) (Performance Criteria A)	IEC60068-2-1: (Test Ad, Operating Cold), IEC60068-2-2: (Test Bd, Operating Dry Heat), IEC60068-2-14: (Test Nb, Operating Thermal Shock)	-20 °C to 65 °C (-4 °F to 149 °F)
Temperature (Non-operating) (Performance Criteria B)	IEC60068-2-1: (Test Ab, Unpackaged Non-operating Cold), IEC60068-2-2: (Test Bb, Unpackaged Non-operating Dry Heat), IEC60068-2-14: (Test Na, Unpackaged Non-operating Thermal Shock)	-40 °C to 85 °C (-40 °F to 185 °F)

Environmental Tests	Industry Standards	Test Level Limits
Humidity (Operating) (Performance Criteria A)	IEC60068-2-30: (Test Db, Unpackaged Damp Heat):	5 to 95% non-condensing
Vibration (Operating) (Performance Criteria A)	IEC60068-2-6: (Test Fc, Operating)	5 G at 10 to 500 Hz, 0.030 in. max. peak-to-peak
Shock (Operating) (Performance Criteria A)	IEC60068-2-27: (Test Ea, Unpackaged Shock)	30 g, 11 ms half-sine (3 mutually perpendicular axes)
Shock (Non-operating) (Performance Criteria B)	IEC60068-2-27: (Test Ea, Unpackaged Shock)	50 g, 11 ms half-sine (3 mutually perpendicular axes)
Radiated Emissions	CSIPR 11; Group 1, Class A	(Enclosure) Class A, 30 MHz–1 GHz
Conducted Emissions	IEC 61000-6-4:2007	Group 1, Class A (AC Mains), 150 kHz–30 MHz
ESD immunity (Performance Criteria B)	IEC 61000-4-2	6 kV Indirect (Coupling Plate) 6 kV Contact Discharge (to points of initial contact) 8 kV Air Discharge (to points of initial contact)
Radiated RF immunity (Performance Criteria A)	IEC 61000-4-3: Level 3	10 V/M with 1 kHz sine-wave 80% AM from 80...2000 MHz 10 V/M with 200 Hz sine-wave 50% Pulse 100% AM at 900 MHz 10 V/M with 200 Hz sine-wave 50% Pulse 100% AM at 1890 MHz 1 V/M with 1 kHz sine-wave 80% AM from 2000...2700 MHz
EFT/B immunity (Performance Criteria B)	IEC 61000-4-4*	Signal Ports: ±3 kV at 5 kHz for 5 minutes, Criteria B (Marine) ±2 kV at 5 kHz for 5 minutes, Criteria A (Marine) ±2 kV at 5 kHz for 5 minutes, Criteria B (standard) Power Ports: ±2 kV at 5 kHz for 5 minutes, Criteria A (Marine) ±2 kV at 5 kHz for 5 minutes, Criteria B (standard)

Environmental Tests	Industry Standards	Test Level Limits
Surge transient immunity (Performance Criteria B)	IEC 61000-4-5	Signal Ports: ±2 kV line-earth {CM} at 2Ω on shielded ports Power Ports ±2 kV CM at 12Ω ±1 kV DM at 2Ω
Conducted RF immunity (Performance Criteria A)	IEC 61000-4-6	10 V rms with 1 kHz sine wave 80% AM from 150 kHz...80 MHz on signal and power ports
Magnetic Field (Performance Criteria A)	IEC 61000-4-8	30 Arms/m
AC Mains Voltage Dips, Interruptions and Variations	IEC 61000-4-11	Follow the 61000-4-11.

Regulatory Requirements

Safety Tests	Industry Standards
UL Safety	UL 508, 17th Edition Safety for Industrial Control Equipment (NRAQ, NRAQ7) CAN/CSA C22.2 No. 142-M1987 (Reaffirmed 2006), Industrial Products, Process Control Equipment.
UL Hazardous Locations	ANSI/ISA–12.12.01 Nonincendive Electrical Equipment for Use in Class I, Division 2 Hazardous (Classified) Locations (NRAG) CSA C22.2 No. 213-M1987 - Non-incendive Electrical Equipment for use in Class I Division 2 Hazardous Locations - March 1987 (NRAG7) Temp code T4 or better, Pollution degree 2, gas groups A, B, C, & D
CE EMC Directive	EN 61131-2 Programmable Controllers: Third Edition 2007-02, Clause 8, Zones A&B EN 61000-6-2: Generic Industrial Immunity EN 61000-6-4: Generic Industrial Emissions
UKCA	Electromagnetic Compatibility Regulations 2016 BS EN 61131-2, BS EN 61000-6-4, BS EN 61000-6-2
FCC	27 CFR Part 15, Class A
CMIM	Arrêté ministériel n° 6404-15 du 29 ramadan 1436 (16 juillet 2015) NM EN 61131-2, NM EN 61000-6-4, NM EN 61000-6-2, NM EN 61010-2-201

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