Hardware Instruction Manual

C4X

4-Channel Modular PID Controller

CHROMALOX
Advanced Thermal Technologies

PK554
0037-75577
October 2018

Table of Contents

Important Safeguards

⚠WARNING

HIGH VOLTAGE (up to 250 VAC) is used in the operation of this equipment; DEATH ON CONTACT may result if personnel fail to observe safety precautions.

Learn the areas containing high-voltage connections when installing or operating this equipment.

⚠WARNING

Be careful not to contact high-voltage connections when installing or operating this equipment.

Before working inside the equipment, turn power off and ground all points of high potential before touching them.

⚠CAUTION

The owner/installer must provide all necessary safety and protection devices and follow all current electrical wiring standards and regulations. Failure to do so may compromise the integrity of the controller and/or cause product failure resulting in a safety risk to operational and service personnel.

⚠WARNING

ELECTRIC SHOCK HAZARD: Any installation involving control equipment must be performed by a qualified person and must be effectively grounded in accordance with the National Electrical Code to eliminate shock hazard.

1. Initial Instructions

1.1 General Description

The C4X completes the family of PID & Power Controllers from Chromalox that includes the C4, C4-IR, and now the C4X. The C4X is a compact advanced 4 Zone PID controller that provides a unique combination of performance, reliability, flexibility, and includes communication interfaces for many popular fieldbus standards. The C4X is a standalone PID controller. It is also used as the control circuit within Chromalox's C4 Family Modular Power Control.

Standard features: Four universal process inputs including thermocouple, RTD, analog 0-10VDC, 4-20mA with custom lineari-zation feature, autotuning PID, OFF/ON Control, heat only, cool only, and heat/cool. Up to 8 freely assigned alarms with AND/OR Logic. Alarms can be set as absolute, deviation, direct , reverse, latching, and disabled at power up. Other features include diagnostics, auto/manual, softstart, and standard Modbus RTU communications.

Output choices range from Relay, Logic for control of SSR's, Triac, and Continuous analog output including 0-10 VDC, 4-20mA, 0-20mA, and 2-10VDC. Optional features include: four Current Transformers (input), additional four analog inputs, four config-urable outputs that can be relay, triac, logic for SSR's, or analog 0-10VDC or 4-20mA. Fieldbus Communication protocols in-cluding Modbus TCP, Real Time Ethernet (Ethernet IP), EtherCAT, Devicenet, Profibus, and Profinet.

This new Chromalox controller is the ideal PID solution for applications demanding high performance, continuous service, compact space, remote locations, specialized fieldbus interfaces, preventative maintenance information, and increasingly need for process data and information for quality and process improvement analysis. Industry areas such as:

- Packaging
- Plastics Processing; Extrusion; Thermforming; Injection Molding, Welding & Joining
- Semiconductor
- Material Finishing; Paint Booths;
- Textile
- Multiple zoned furnaces; Tunnel Ovens
- Food Processing

1.2 Features

- Solid state relay control
- Current transformers (four)
- 4 universal main inputs
- 4 heat/cool independent PID
- 4 main output internally wired to the SSR
- 4 auxiliary analog inputs (option)
- 4 configurable output (option): relay / logic / analog/ TRIAC
- 2 configurable relay alarm output
- 2 digital inputs
- Standard digital communication: Modbus RTU/ RS485
- Optional Fieldbus communication: Profibus DP, CANopen, DeviceNet, Modbus RTU, Ethernet Modbus TCP, Real Time Ethernet (Ethernet IP), EtherCAT, ProfiNET
- DIN rail mounting
- cULus, CE

1.3 Product Inspection

Immediately after unpacking the unit and prior to installing, check the order code and the other data on the label attached to the outside of the container and write them down. If troubleshooting is necessary, you will need to provide this data to a Chro-malox customer service representative.

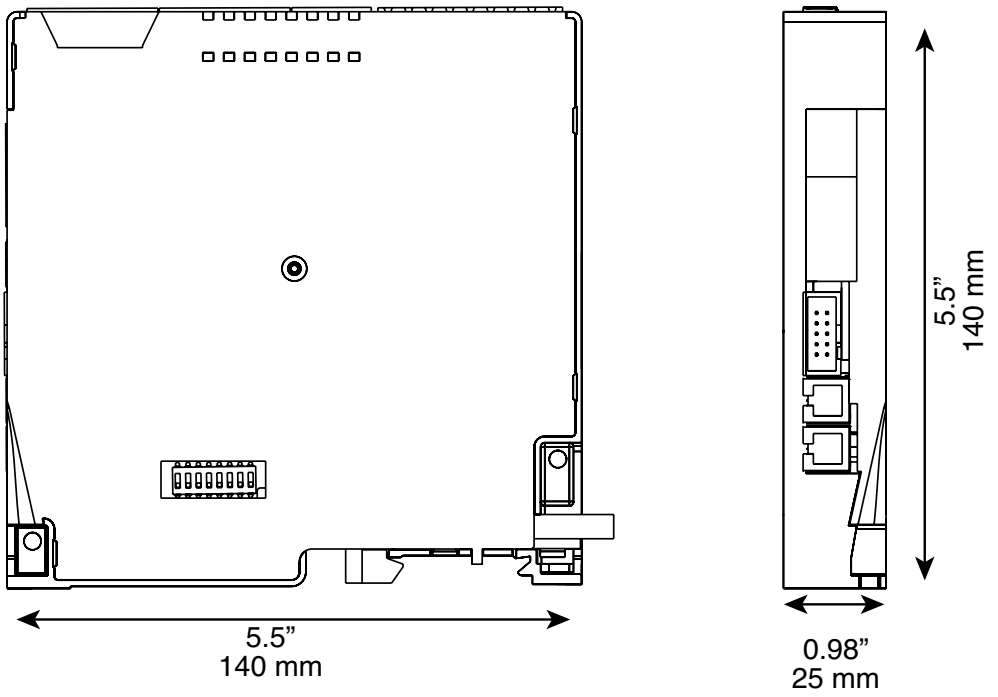
Upon removing package, ensure that there is no physical damage to the controller during shipment, and that the package also contains the **"Configuration and Programming"** manual.

If there are signs of damage or if any parts are missing, notify your Chromalox representative immediately.

Read through all installation sections in detail within this document before installing the C4 on any piece of equipment or in a control panel enclosure. Spacing requirements must be honored for proper operation and safety.

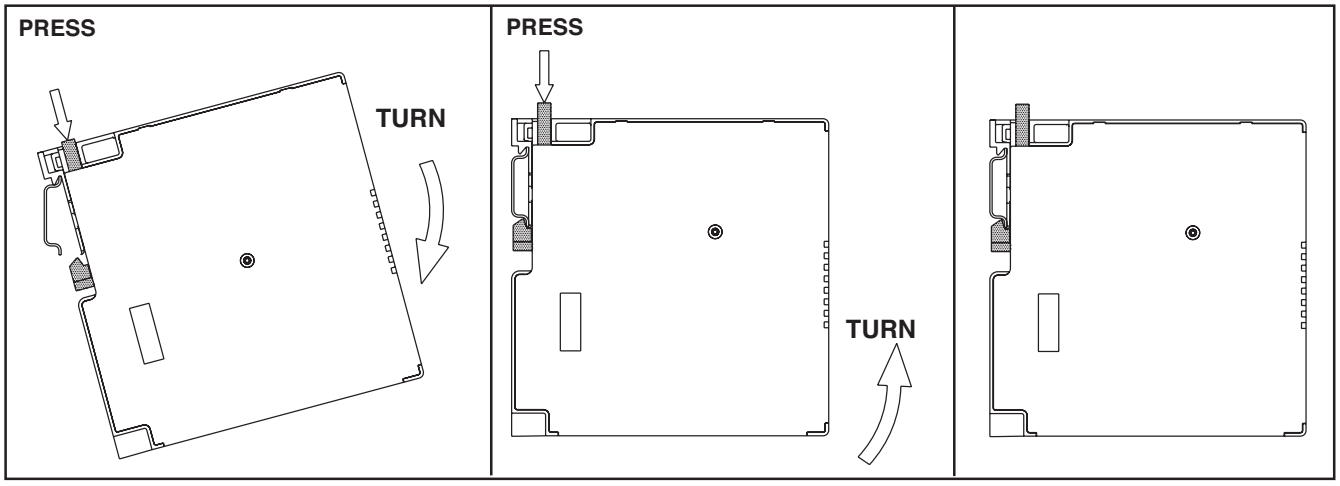
2. Dimensions and Installation

Fastening may be done on DIN guide (EN50022) or with (5MA).



For correct attachment/release of the module on the DIN guide, do as follows:

1. keep the attach/release cursor pressed
2. insert/remove the module
3. release the cursor



3. Wiring

This section covers the C4/C4X wiring installation instructions for the power supply, inputs, outputs and interfaces.

⚠WARNING

CAREFULLY READ THE FOLLOWING WARNINGS BEFORE INSTALLING THE INSTRUMENT!

Failure to obey these warnings could create electrical safety and electromagnetic compatibility problems, as well as void the warranty and cause personal injury or death.

Electrical Power Supply

- The controller DOES NOT have an On/Off switch. The user must install a switch or isolator that conforms to all codes and electrical safety requirements (CE mark) to cut off the power supply upstream of the controller. The switch must be installed in the immediate vicinity of the controller and within reach of the operator. A single switch can be used for multiple devices.
- The earth connection must be made with a specific lead.
- If the product is used in applications with risk of harm to persons or damage to machines or materials, it MUST be equipped with auxiliary alarm device(s). It is advisable to provide the ability to check for tripped alarms during regular operation. DO NOT install the product in rooms with hazardous (inflammable or explosive) atmosphere; it may be connected to elements that operate in such atmosphere only by means of appropriate interfaces that conform to current safety standards.

Notes on Electrical Safety and Electromagnetic Compatibility

CE MARKING: EMC (electromagnetic compatibility) conformity in compliance with Directive 2004/108/CE and following modifications. Series C4 controllers are mainly intended for industrial use, installed on panels or control panels of production process machines or systems. For purposes of electromagnetic compatibility, the most restrictive generic standards have been adopted, as shown on the tables.

LV (low voltage) conformity Directive 2006/95/CE. EMC compliance has been verified with respect to the information in Tables 1 and 2.

<u>Recommended Installation for purposes of EMC</u>
Instrument power supply

- The power supply for the electronic instrumentation on the panels must always come directly from a cut/off device with fuse for the instrument part.
- Electronic instrumentation and electromechanical power devices such as relays, contactors, solenoids, etc., MUST ALWAYS be powered by separate lines.
- When the power supply line of electronic instruments is heavily disturbed by switching of SCR power groups or by motors, you should use an isolation transformer only for the controllers, grounding its sheathing.
- It is important for the system to be well grounded. Voltage between neutral and ground must not be > 1 V and resistance must be < 6Ω (Ohms).
- If the grid voltage is highly unstable, use a voltage stabilizer.
- In proximity of high frequency generators or arc welders, use adequate grid filters.
- The power supply lines must be separate from instrument input and output lines.
- Supply from Class II or from limited energy sources.

Input and output connections

Before connecting or disconnecting any connection, always check that the power and control cables are isolated from voltage. Appropriate devices must be provided: fuses or automatic switches to protect power lines.

- Connected outside circuits must be doubly isolated.
- To connect analog or linear inputs, strain gauges, TC, RTD, etc., you have to:
  - physically separate the input cables from those of the power supply, outputs, and power connections.
  - use braided and shielded cables, with sheathing grounded at a single point.
- To connect the control outputs and alarm outputs (contactors, solenoids, motors, fans, etc.), install RC (series of capacitors and resistors) groups parallel to inductive loads that work in AC.

  (Note: all condensers must conform to VDE standards (class X2) and support voltage of at least 220Vac. Resistances must be at least 2W).
- Install a 1N4007 diode parallel to the coil of inductive loads that work in DC.

4. Emission, Immunity and Safety Standards

Table 1: EMC Emission

Generic standards, emission standard for industrial environments	EN 61000-6-4	
Emission enclosure	CEI EN 61000-6-4 CISPR-16-1-4 CISPR-16-2-3 CEI R210-010	Class A

Table 2: EMC Immunity

Generic standards, immunity standard for industrial environments	EN 61000-6-2	
ESD immunity	EN 61000-4-2	4 kV contact discharge 8 kV air discharge
RF interference immunity	EN 61000-4-3 /A1	10 V/m amplitude modulated 80 MHz-1 GHz 10 V/m amplitude modulated 1.4 GHz-2 GHz
Conducted disturbance immunity	EN 61000-4-6	10 V/m amplitude modulated 0.15 MHz-80 MHz
Burst immunity	EN 61000-4-4	2 kV power line 2 kV I/O signal line
Pulse immunity	EN 61000-4-5	Power line-line 1 kV (level 2) Power line-earth 2 kV (level 3) Signal line-earth 1 kV (level 2)
Magnetic fields immunity	EN 61000-4-8	100 A/m (level 5)
Voltage dips, short interruptions and voltage immunity tests	EN 61000-4-11	100%U, 70%U, 40%U

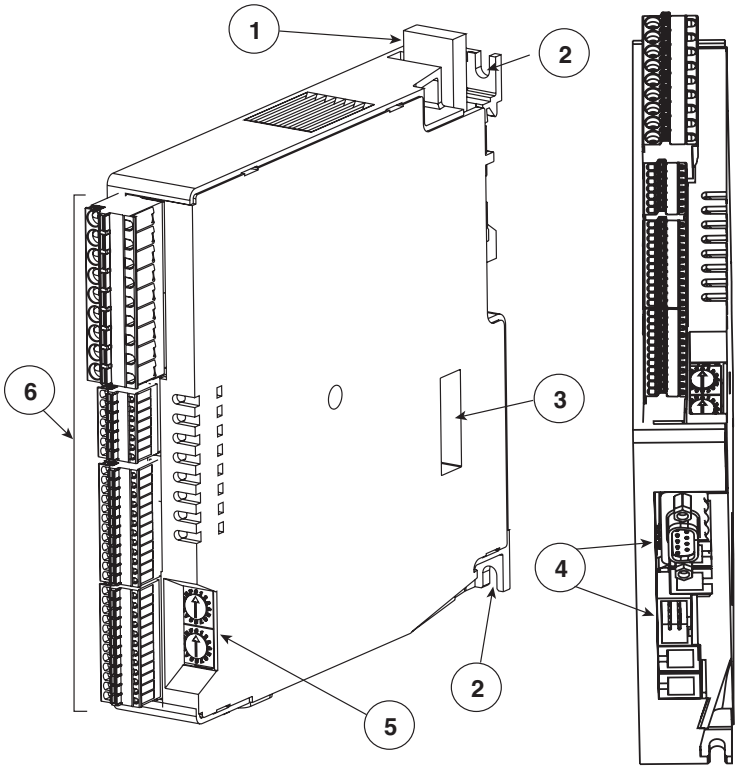
Table 3: LVD Safety

Safety requirements for electrical equipment for measurement, control and laboratory use	EN 61010-1	

The CE declaration of conformity is available on request.

5. Controller Overview

5.1 General Description



1. cursor for insertion/removal of DIN bar attachment
2. access for screwdriver to power connector screws
3. dip switches for function configuration
4. connectors for communication ports (Port1, Port2)
5. rotary switches for setting node address or number
6. signal and power supply connectors (J1, J2, J3, J4)

5.2 Inserting the FieldBus Interface Board

Do as follows:

a. Unscrew screw **16**

b. With a screwdriver, gently apply leverage at points **18**

c. Remove cover **17**

d. Place interface board **19** on the connectors on board **21**

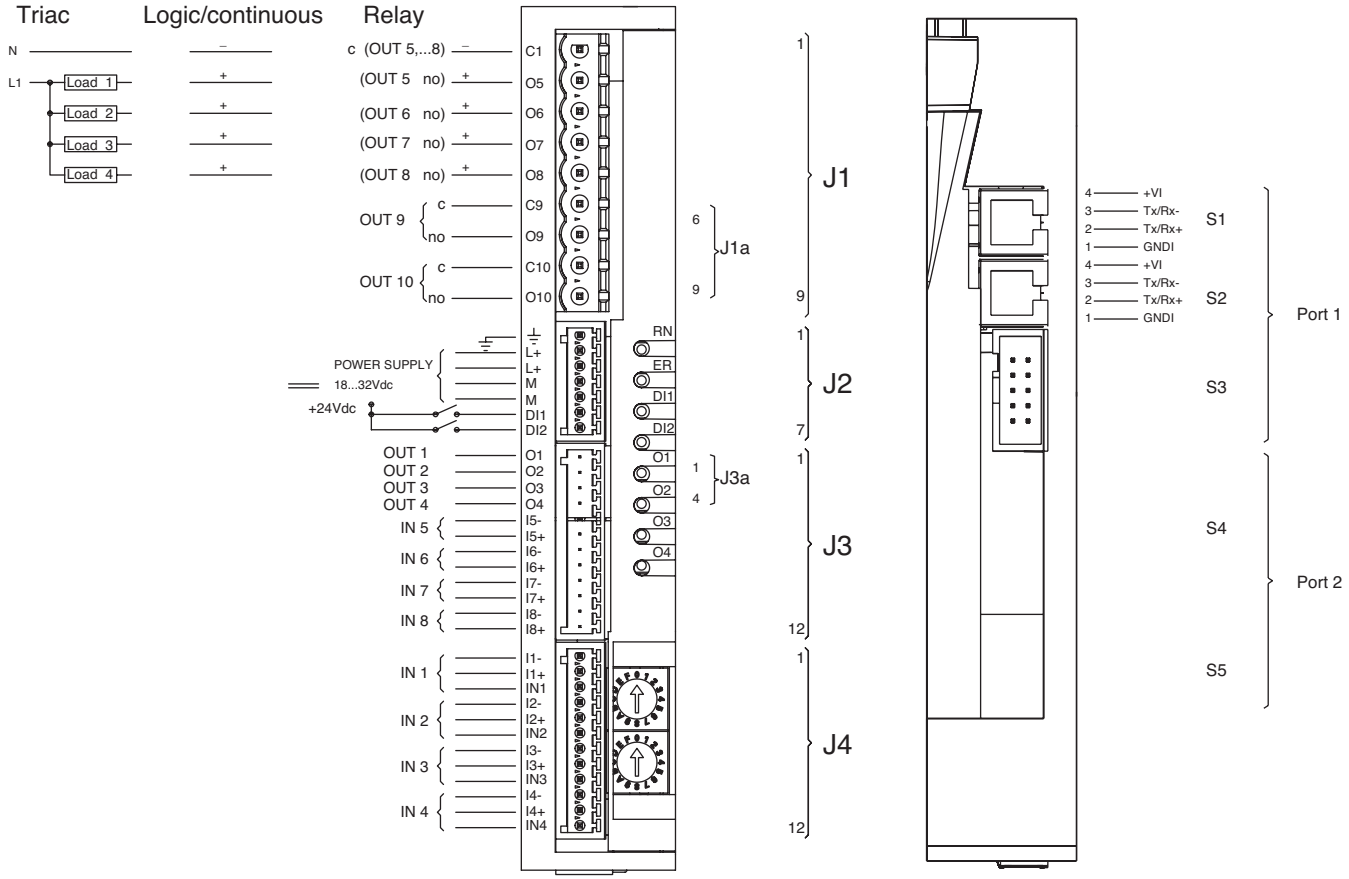
e. Remove pre-broken parts **20** on cover **17** based on the type of interface installed

f. Reposition cover **17** in its housing

g. Tighten screw **16**

5.3 Input & Output Connections

- Use adequately compensated cable for thermocouple inputs. Maintain polarity by avoiding junctions on the cables.
- If using a grounded thermocouple, the connection must be at a single point.
- For RTD inputs, use copper extension cables and avoid junctions on the cables. Resistance must not exceed 20 Ohm.
- For 2-wire RTDs, make the connection indicated instead of the third wire.
- Refer to the applicable Connectors Detail starting in section 7.5



5.4 LED Logic

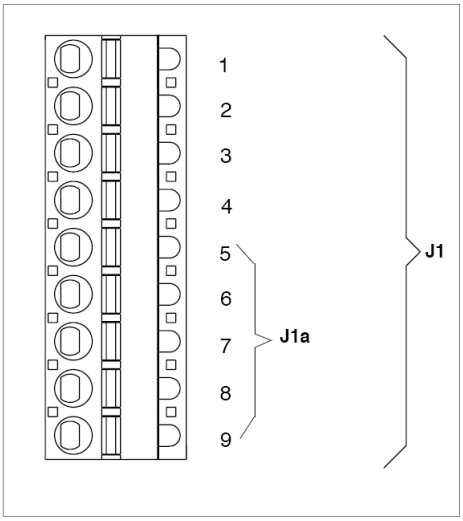
LED	Description	Color
RN	RUN - Flashes during regular operation	Green
ER	ERROR (Fault Condition) - Illuminates when a fault is present Lo = Process Variable value < Lo.S HI = Process Variable value > Hi.S Sbr = Sensor interrupted or input values over maximum limits Err = RTD third wire interrupted for Pt100 or input values below minimum ER = (red) flashing: Alarm temperature OVER_HEAT (STATUS.STRUMENTO 4 bit 1)	Red
DI1	State of digital input 1: DI1	Yellow
DI2	State of digital input 2: DI2	Yellow
O1	State of output 1: O1	Yellow
O2	State of output 2: O2	Yellow
O3	State of output 3: O3	Yellow
O4	State of output 4: O4	Yellow

5.5 Rotary Switches

Switch	Description
 X10 X1	Defines Address of Controller Module Available address: 00...99

5.6 Connector Detail

5.6.1 Connector J1 / J1a (Note: If Auxiliary Outputs O5 - O8, are present, connector J1a becomes J1.)



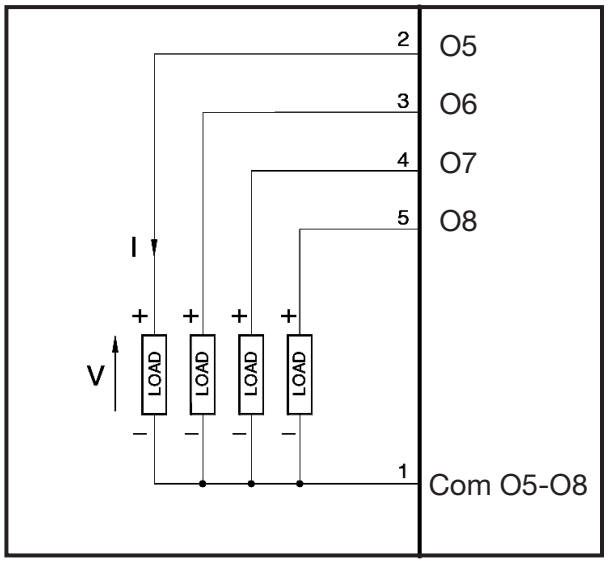
	0.2 - 2.5mm²	24-14 AWG
	0.25 - 2.5mm²	23-14 AWG

<u>Outputs 5 - 8: Logic or Analog Output Type</u>

Logic outputs: 18 - 36Vdc, max 20mA

Analog outputs: Voltage (default): 0 - 10V, 2 - 10V, max 25mA or Current: 0 - 20mA, 4 - 20mA, max 500Ω

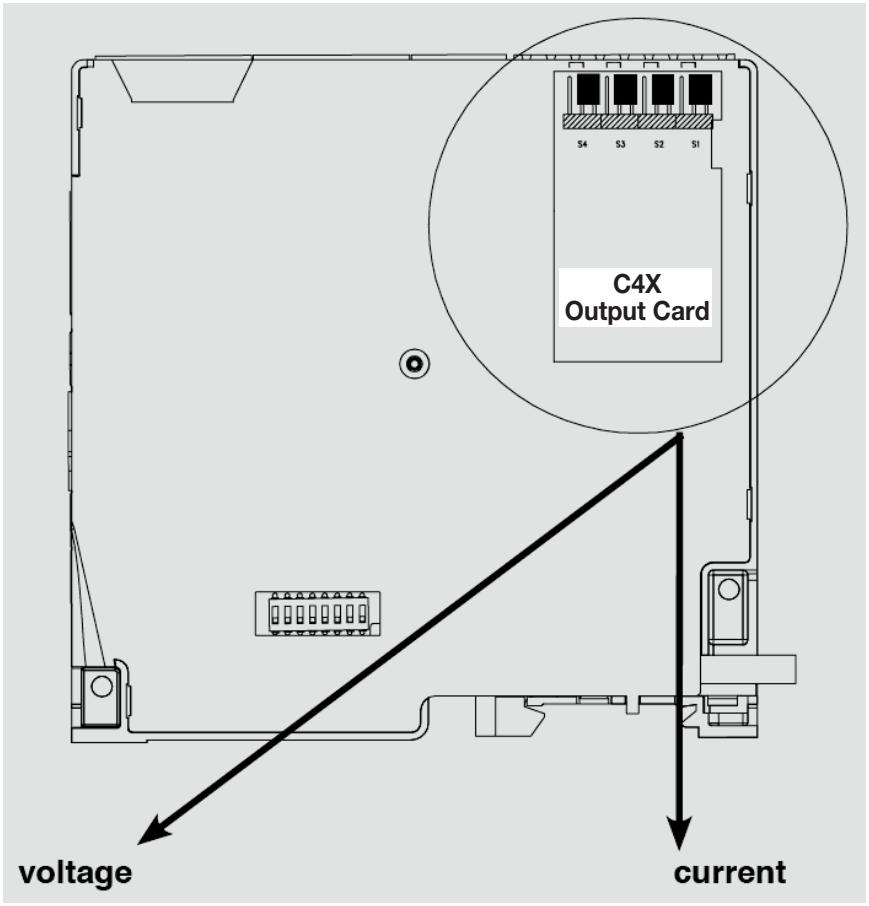
Wiring Schematic for Outputs 5 - 8, both Logic & Analog Outputs

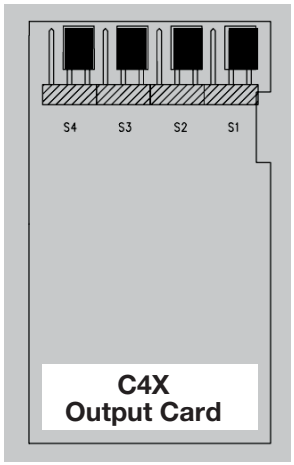


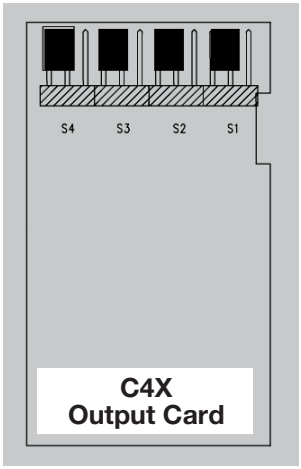
PIN Legend

PIN	Name	Description	Polarity (Logic or Analog)
1	Com O5-O8	Outputs Common	(–)
2	O5	Output 5	(+)
3	O6	Output 6	(+)
4	O7	Output 7	(+)
5	O8	Output 8	(+)

When the optional Auxiliary Output type “A” (Analog) is selected, one must choose whether the output is Voltage-based (default) or Current-based. This selection is carried out via proper jumper placement on the board as follows:



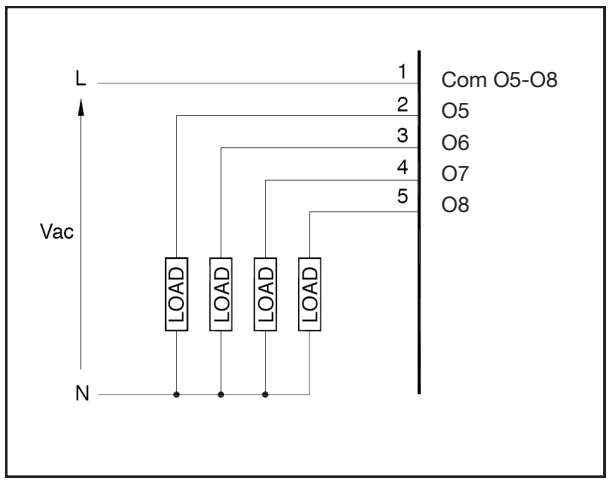




Outputs 5 - 8: TRIAC Type

TRIAC outputs: Voltage: 24...230Vac, max 1A

Wiring Schematic for Outputs 5 - 8, TRIAC Outputs



PIN Legend

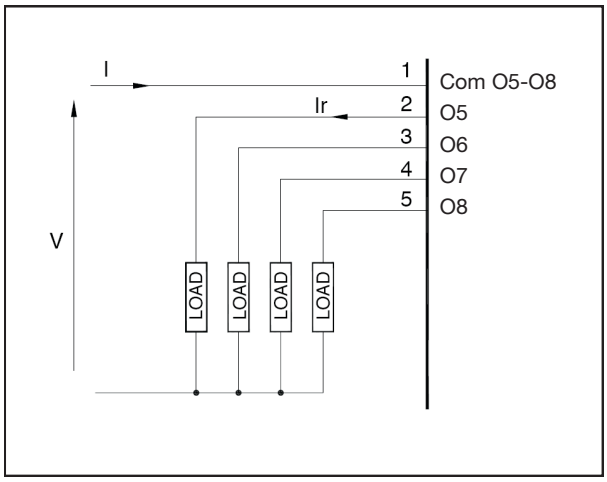
PIN	Name	Description
1	Com O5-O8	Outputs Common
2	O5	Output 5
3	O6	Output 6
4	O7	Output 7
5	O8	Output 8

Outputs 5 - 8: Relay Type

Outputs Out 5 - Out 8, Relay outputs: Ir = 3A max, NO (normally open)

V = 250V/30 Vdc cosφ = 1; I = 12A max

Wiring Schematic for Outputs 5 - 8, Relay Outputs



PIN Legend

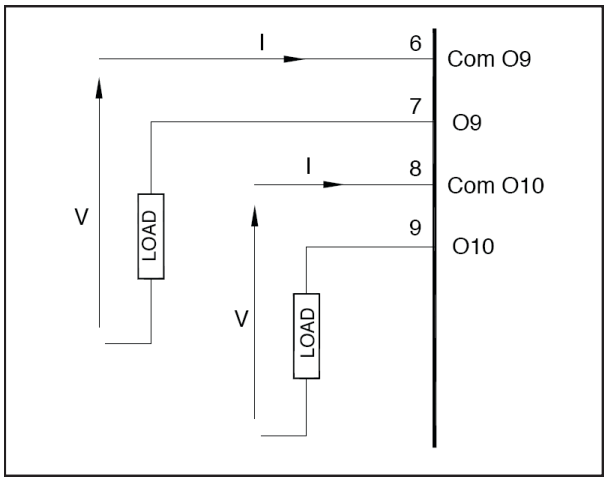
PIN	Name	Description
1	Com O5-O8	Outputs Common
2	O5	Output 5
3	O6	Output 6
4	O7	Output 7
5	O8	Output 8

Outputs 9, 10: Relay Type

Outputs Out 9, Out 10, Relay outputs: 5A max

V = 250V/30Vdc cosφ = 1; I = 5A max

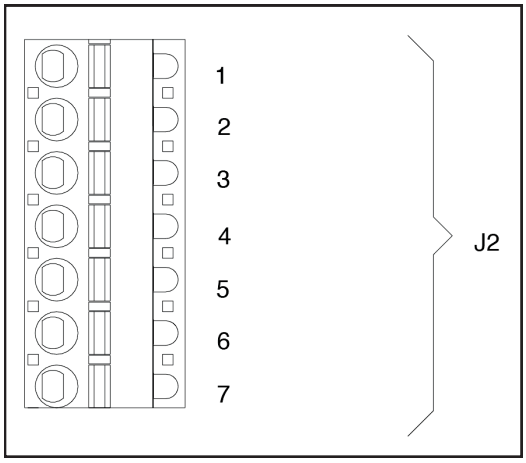
Wiring Schematic for Outputs 9 & 10, Relay Outputs



PIN Legend

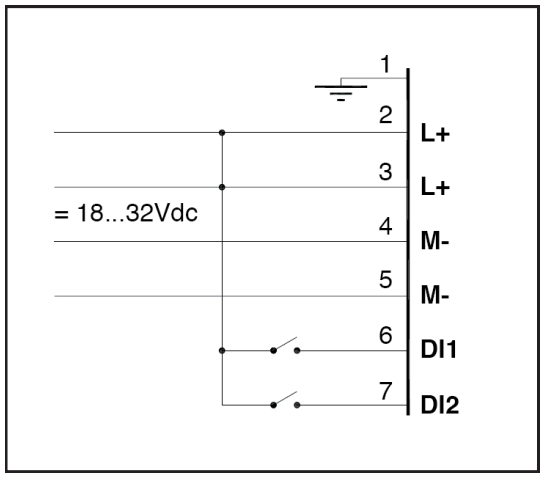
PIN	Name	Description
1	Com O9	Output Common O9
2	O9	Output O9
3	Com O10	Output Common O10
4	O10	Output O10

5.6.2 Connector J2 (Power Supply, Digital Input 1 & Digital Input 2)



	0.14 - 0.5mm²	28-20AWG
	0.25 - 0.5mm²	23-20AWG

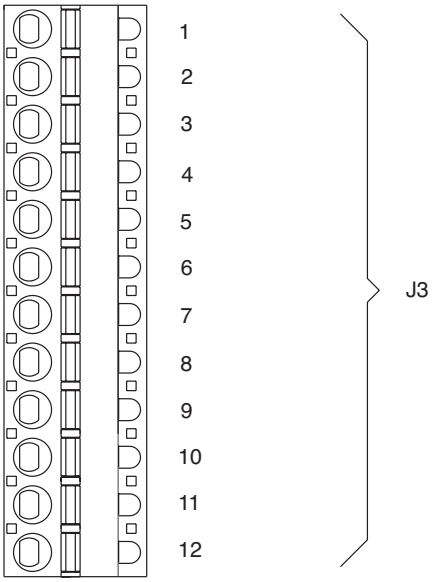
Wiring Schematic for J2 - Power Supply, Digital Inputs

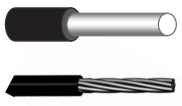


PIN Legend

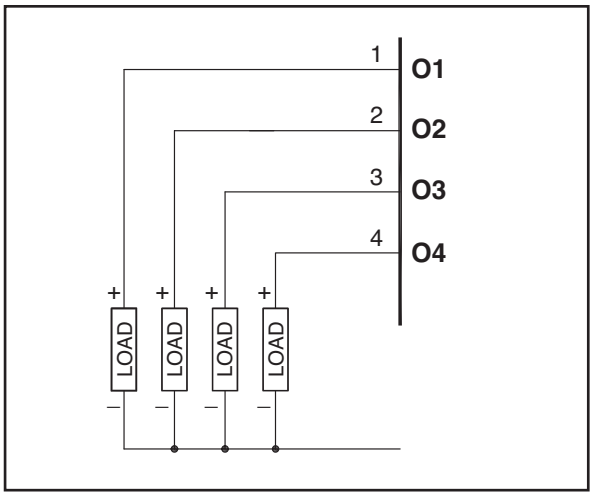
PIN	Name	Description
1	⏚	Ground
2	L+	Power Supply 18 - 32 Vdc
3	L+	
4	M-	
5	M-	
6	DI1	Digital Input 1
7	DI2	Digital Input 2

5.6.3 Connector J3 (Auxiliary Inputs)



	0.14 - 0.5mm²	28-20 AWG
	0.25 - 0.5mm²	23-20 AWG

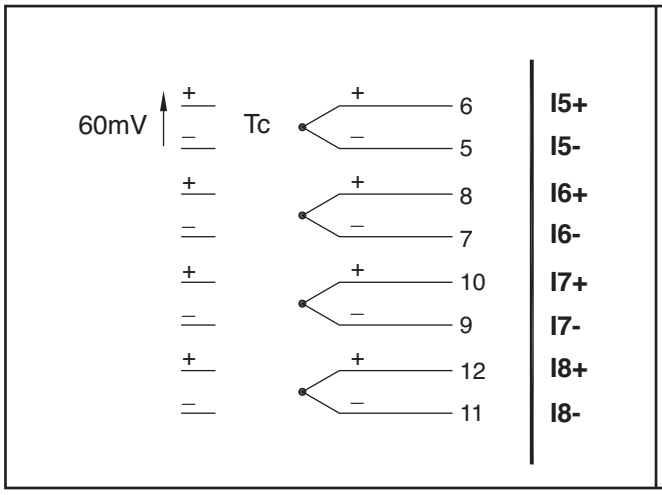
Wiring Schematic for J3 - Auxiliary Inputs



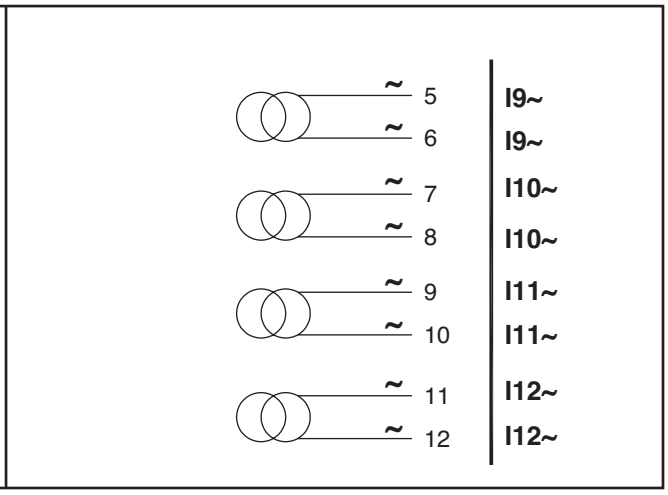
PIN Legend

PIN	Name	Description
1	O1	Output Out1
2	O2	Output Out2
3	O3	Output Out3
4	O4	Output Out4
5	I5-	Auxiliary input (I5) or CT Input (I9)
6	I5+	
7	I6-	Auxiliary input (I7) or CT Input (I11)
8	I6+	
9	I7-	Auxiliary input (I8) or CT Input (I12)
10	I7+	
11	I8-	Auxiliary input (I6) or CT Input (I10)
12	I8+	

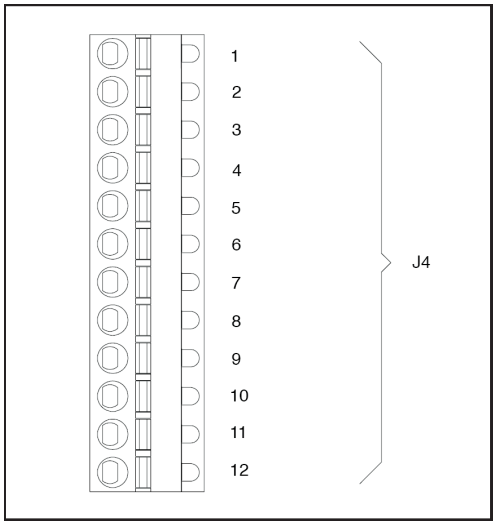
Connection Scheme for 60mV/TC aux. linear inputs



Connection Scheme for CT inputs



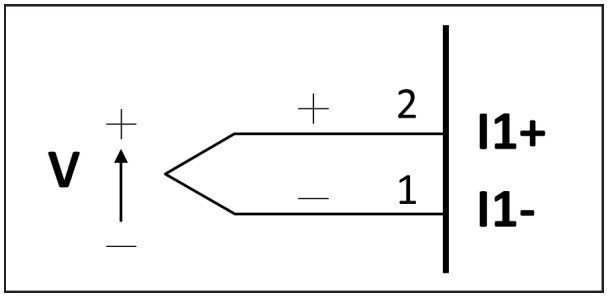
5.6.4 Connector J4 (Inputs 1 - 4)



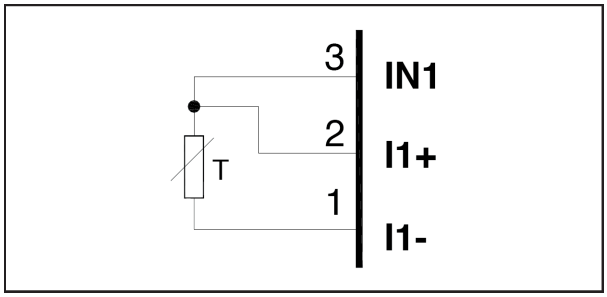
	0.14 - 0.5mm²	28-20 AWG
	0.25 - 0.5mm²	23-20 AWG

Inputs 1 - 4

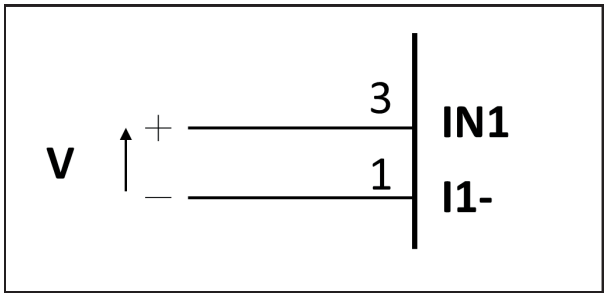
Wiring Schematic for 60mV TC or Linear (Analog) input



Wiring Schematic for RTD (Pt100) input



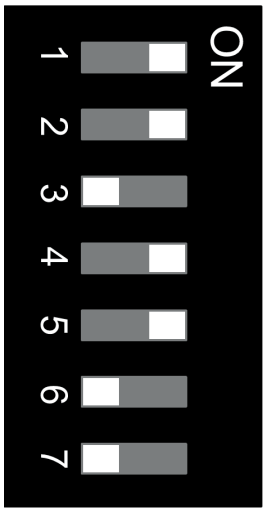
Wiring Schematic for 1V / 20mA Linear (Analog) input

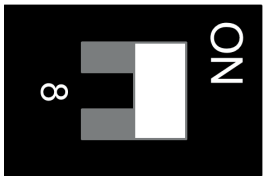


PIN Legend

PIN	60mV/Tc Linear Input	1V/20mA Linear Input	Pt100 Input
1	I1-	I1-	I1-
2	I1+		I1+
3		IN1+	IN1
4	I2-	I2-	I2-
5	I2+		I2+
6		IN2+	IN2
7	I3-	II3-	13-
8	I3+		I3+
9		IN3+	IN3
10	I4-	I4-	I4-
11	I4+		I4+
12		IN4+	IN4

5.7 Dip-Switch Configuration





Dip Switch Legend

Dip Switch	Description
1	See Load Configuration Table Below.
2	
3	
4	No Function
5	No Function
6	ON: Resets Controller to Factory Settings
7	ON: Simulation Mode
8	ON: When the device is the ONLY RS-485 device or when it is the LAST RS-485 device

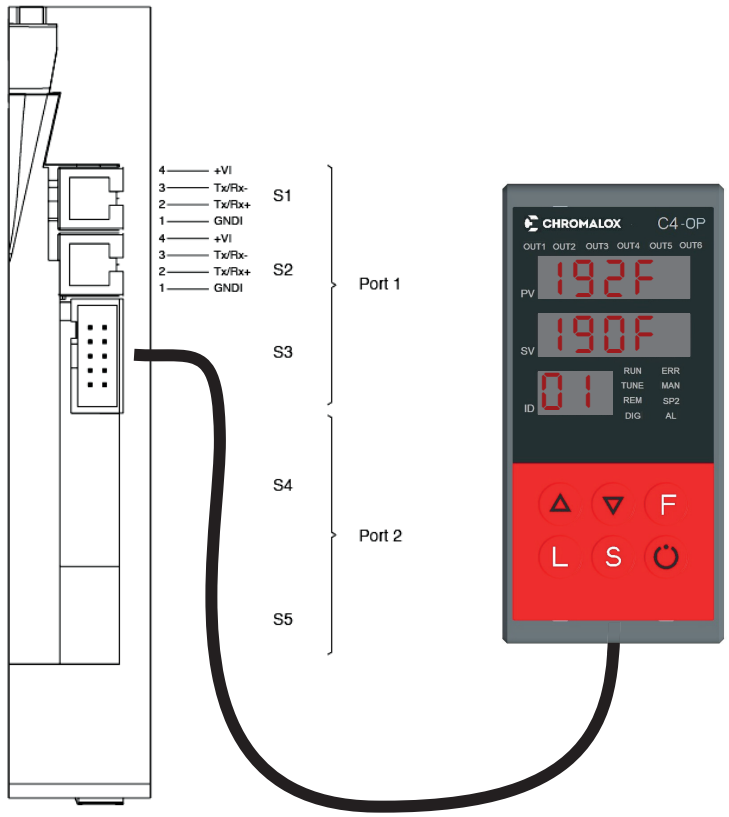
Load Configuration Table

Dip Switch			Load Connection Type
1	2	3	
OFF	OFF	OFF	4 independent zones (4 single-phase loads)
ON	OFF	OFF	Zone 1: 3-phase load, star (wye) connection, with neutral
OFF	ON	OFF	Zone 1: 3-phase load, open delta connection
ON	ON	OFF	Zone 1 & 3: Two 3-phase loads, star (wye) connection, without neutral
OFF	OFF	ON	Zone 1 & 3: Two 3-phase loads, closed delta connection
ON	OFF	ON	No Function
OFF	ON	ON	No Function
ON	ON	ON	No Function

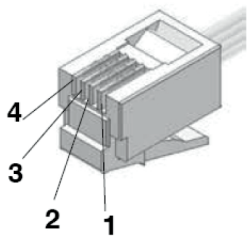
5.8 Serial Communication Ports

5.8.1 Port1 (Standard Local Bus): Connectors S1, S2, S3

Modbus RTU/RS485 Serial Interface

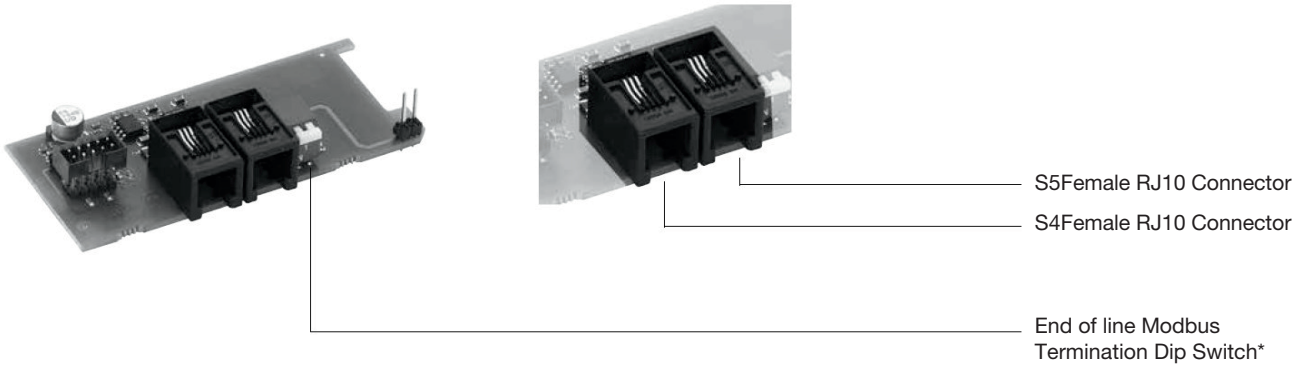


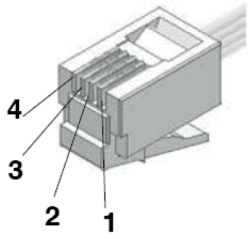
Connector S3 accepts the C4-OP local interface terminal. See the C4-OP Section for more detail.

Connector S1/S2 RJ10 4-4 Pin	Pin	Name	Description	Note
	1	GND1 (**)	-	(*) Enable #8 DIP Switch on last device on Modbus RS485 line (**) Connect the GND signal to Modbus devices with a line distance > 300 ft. (100 m)
	2	Tx/Rx+	Data reception/transmission (A+)	
	3	Tx/Rx-	Data reception/transmission (B-)	
	4	+V Reserved	-	
Cable Type: Flat telephone cable for pin 4-4 conductor 28 AWG				

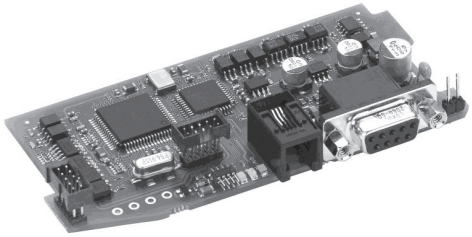
5.8.2 Port2 (Optional Fieldbus): Connectors S4, S5

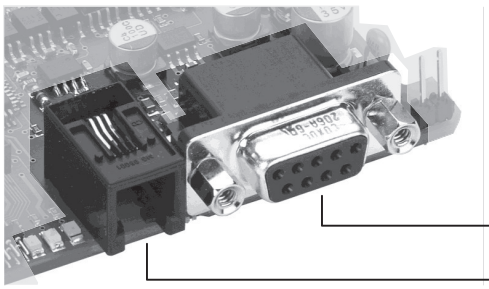
A. Modbus RTU/RS485, Modbus RTU/RS485

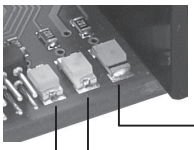


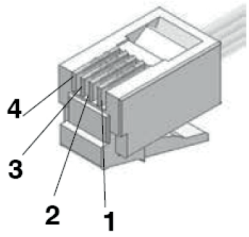
Connector S4/S5 RJ10 4-4 Pin	Pin	Name	Description	Note
	1	GND1 (**)	-	(*) Enable Fieldbus DIP Switch on last device on Modbus RS485 line (**) Connect the GND signal to Modbus devices with a line distance > 300 ft (100 m)
	2	Tx/Rx+	Data reception/transmission (A+)	
	3	Tx/Rx-	Data reception/transmission (B-)	
	4	+V Reserved	-	
Cable Type: Flat telephone cable for pin 4-4 conductor 28 AWG				

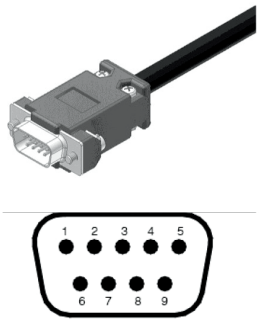
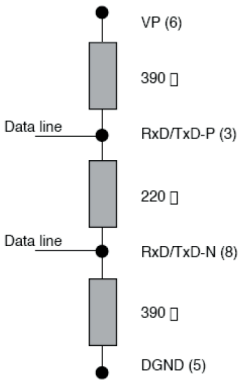
B. Modbus RTU/RS485, Profibus DP Interface



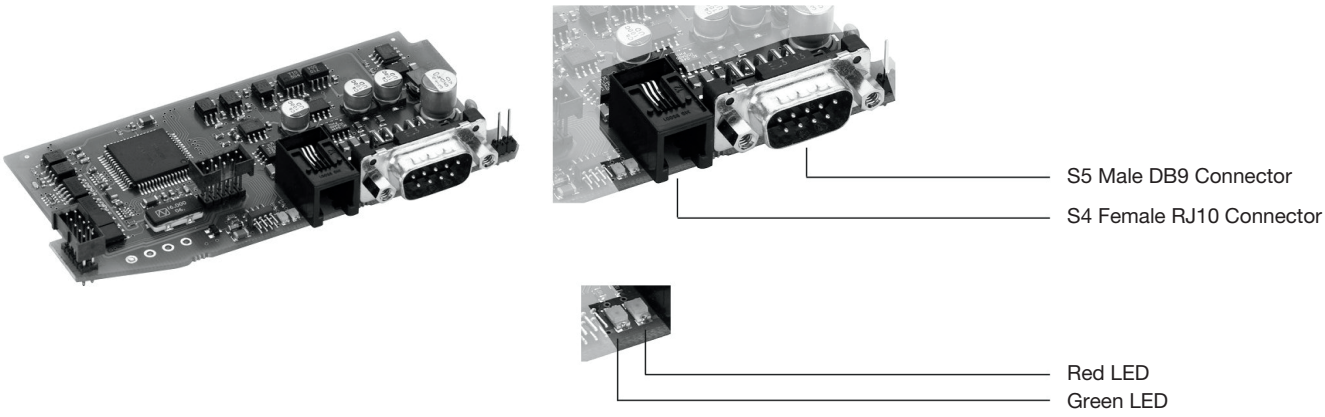


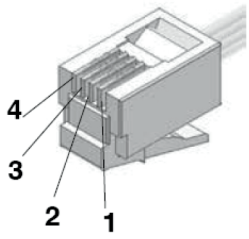


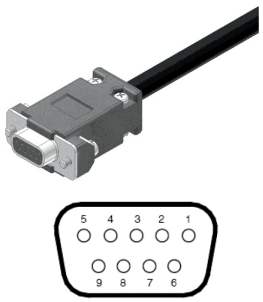
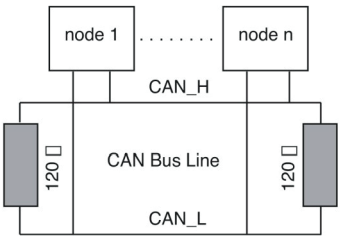
Connector S4 RJ10 4-4 Pin	Pin	Name	Description	Note
	1	GND1 (**)	-	(**) Connect the GND signal to Modbus devices with a line distance > 300 ft. (100 m)
	2	Rx/Tx+	Data reception/transmission (A+)	
	3	Rx/Tx-	Data reception/transmission (B-)	
	4	+V Reserved	-	
Cable Type: Flat telephone cable for pin 4-4 conductor 28 AWG				

Connector S5 D-Sub 9 Pins Male	Pin	Name	Description	Note
	1	Shield	EMC Production	Connect the terminal resistances as shown in the figure. 
	2	M24V	Output Voltage - 24V	
	3	RxD/TxD-P	Data reception/transmission	
	4	n.c.	n.c.	
	5	DGND	Data Ground	
	6	VP	Positive Power Supply +5V	
	7	P24V	Output Voltage +24V	
	8	RxD/TxD-N	Data Reception/Transmission	
	9	n.c.	n.c.	
Cable Type: Shielded 1 pair 22 AWG conforming to PROFIBUS.				

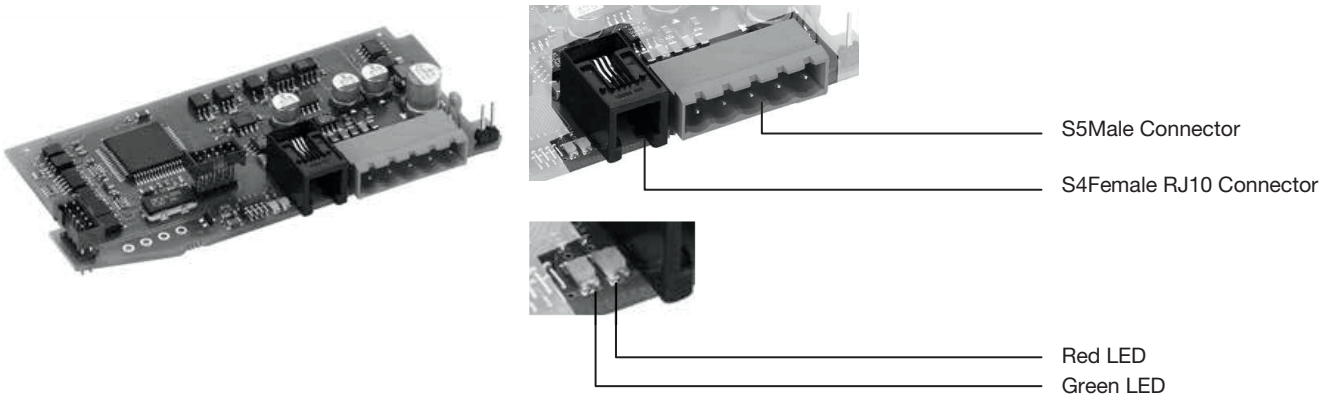
C. Modbus RTU/RS485, CANopen Interface

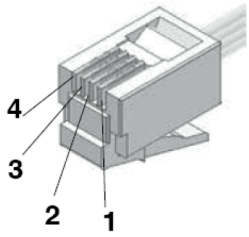


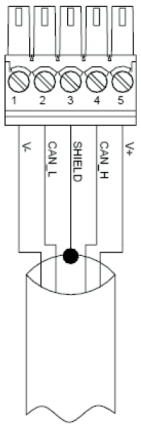
Connector S4 RJ10 4-4 Pin	Pin	Name	Description	Note
	1	GND1 (**)	-	(**) Connect the GND signal among Modbus devices with a line distance > 300 ft. (100 m)
	2	Rx/Tx+	Data reception/transmission (A+)	
	3	Rx/Tx-	Data reception/transmission (B-)	
	4	+V Reserved	-	
Cable Type: Flat telephone cable for pin 4-4 conductor 28 AWG				

Connector S5 D-Sub 9 Pins Female	Pin	Name	Description	Note
	1	-	Reserved	Connect the terminal resistances as shown in the figure. 
	2	CAN_L	CAN_L bus line (domination low)	
	3	CAN_GND	CAN Ground	
	4	-	Reserved	
	5	(CAN_SHLD)	Optional CAN Shield	
	6	(GND)	Optional Ground	
	7	CAN_H	CAN_H bus line (domination High)	
	8	-	Reserved	
	9	(CAN_V+)	Optional CAN external positive supply (dedicated for supply of transceiver and optocouplers, if galvanic isolation of the bus node applies)	
Cable Type: Shielded 2 pairs 22/24 AWG conforming to CANopen.				

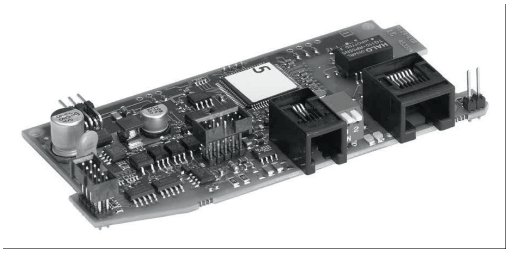
D. Modbus RTU/RS485, DeviceNet Interface

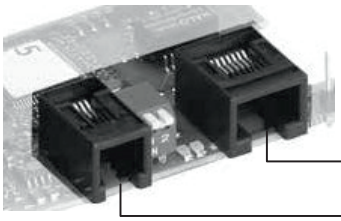


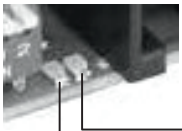
Connector S4 RJ10 4-4 Pin	Pin	Name	Description	Note
	1	GND1 (**)	-	(**) Connect the GND signal to Modbus devices with a line distance > 300 ft. (100 m)
	2	Rx/Tx+	Data reception/transmission (A+)	
	3	Rx/Tx-	Data reception/transmission (B-)	
	4	+V Reserved	-	
Cable Type: Flat telephone cable for pin 4-4 conductor 28 AWG				

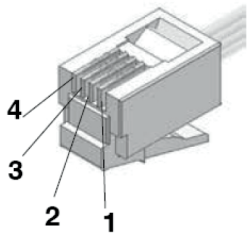
Connector S5 D-Sub 9 Pins Male	Pin	Name	Description	Note
	1	V-	Negative Power Supply	Connect a 120Ω / 1/4W resistance between the “CAN_L” and “CAN_H” signals at each end of the DeviceNet network.
	2	CAN_L	Low Signal	
	3	SHIELD	Shield	
	4	CAN_H	High Signal	
	5	V+	Positive Power Supply	
Cable Type: Shielded 1 pair 22 AWG conforming to PROFIBUS.				

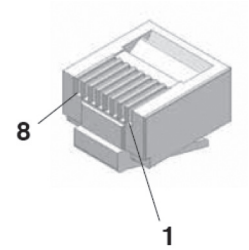
E. Modbus RTU/RS485, Modbus TCP/Ethernet Interface



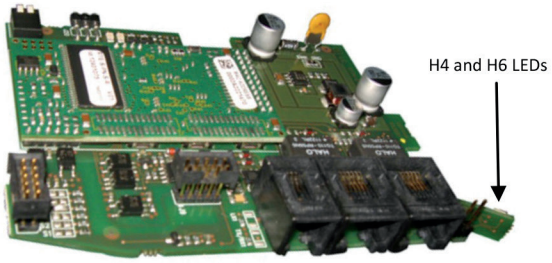




Connector S4 RJ10 4-4 Pin	Pin	Name	Description	Note
	1	GND1 (**)	-	(**) Connect the GND signal among Modbus devices with a line distance > 300 ft. (100 m)
	2	Rx/Tx+	Data reception/transmission (A+)	
	3	Rx/Tx-	Data reception/transmission (B-)	
	4	+V Reserved	-	
Cable Type: Flat telephone cable for pin 4-4 conductor 28 AWG				

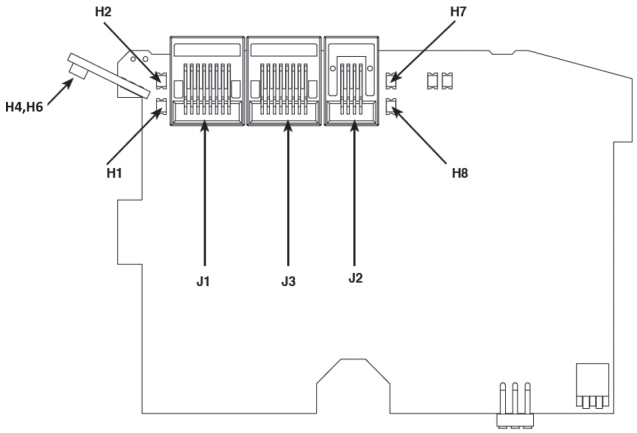
Connector S5 RJ45	Pin	Name	Description	Note
	1	TX+	Data + Transmission	
	2	TX-	Data - Transmission	
	3	RX+	Data + Reception	
	4	n.c.		
	5	n.c.		
	6	RX-	Data - Reception	
	7	n.c.		
	8	n.c.		
Cable Type: Use standard category 6 cable according to TIA/EIA-568A.				

Modbus RTU/RS485, Ethernet IP Interface or Modbus RTU/RS485, EtherCAT Interface or Modbus RTU/RS485, ProfiNET Interface



LED Logic - Ethernet IP Fieldbus Module

H1	LED GREEN Module State		
H2	LED RED Module State		
H7	LED RED Network State		
H8	LED GREEN Network State		
H4	LED Bicolor	GREEN (H1) RED (H2)	
H6	LED Bicolor	GREEN (H8) RED (H7)	
J1	Connector		Port ETH0
J3	Connector		Port ETH1
J2	Connector		Serial Modbus



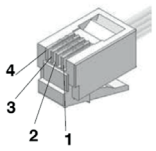
LED Logic - EtherCAT Fieldbus Module

H1	LED GREEN Link/Activity		Port ETH0
H2	LED RED Run		Run
H7	LED RED Run		Run
H8	LED GREEN Link/Activity		Port ETH1
H4	LED Bicolor	GREEN (H1) RED (H2)	Port ETH0
H6	LED Bicolor	GREEN (H8) RED (H7)	Port ETH1
J1	Connector		Port ETH0 (IN)
J3	Connector		Port ETH1 (OUT)
J2	Connector		Serial Modbus

LED Logic - ProfiNet Fieldbus Module

H1	LED GREEN Link		Port ETH0
H2	LED RED Signal		Port ETH0
H7	LED RED Activity		Port ETH1
H8	LED GREEN Link		Port ETH1
H4	LED Bicolor	GREEN (H1) RED (H2)	Port ETH
H6	LED Bicolor	GREEN (H8) RED (H7)	Port ETH
J1	Connector		Port ETH0
J3	Connector		Port ETH1
J2	Connector		Serial Modbus

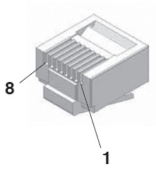
Connector J2 RJ10 4-4 Pin



Pin	Name	Description	Note
1	GND1 (**)	-	(**) It is adviseable to also connect the GND signal between Modbus devices with a line distance > 300 ft. (100 m)
2	Tx/Rx+	Data reception/ transmission (A+)	
3	Tx/Rx-	Data reception/ transmission (B-)	
4	+V Reserved	-	

Cable Type: Flat telephone cable for pin 4-4 conductor 28 AWG

Connector J1 and J3 RJ45



Pin	Name	Description	Note
1	TX+	Data Transmission +	
2	TX-	Data Transmission -	
3	RX+	Data Reception +	
4	n.c.		
5	n.c.		
6	RX-	Data Reception -	
7	n.c.		
8	n.c.		

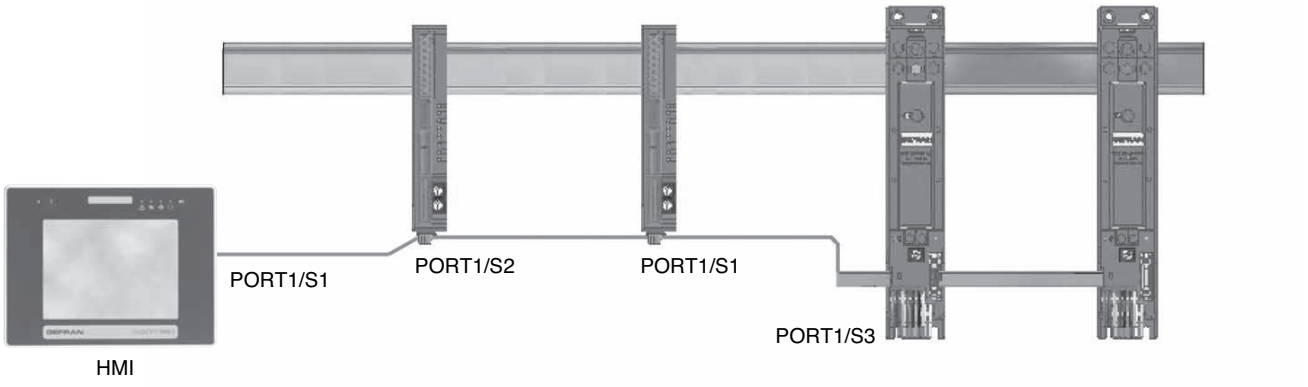
Cable Type: Use standard category 5 cable according to TIA/ EIA-568B

5.8.3 Connection Example: Communication Ports

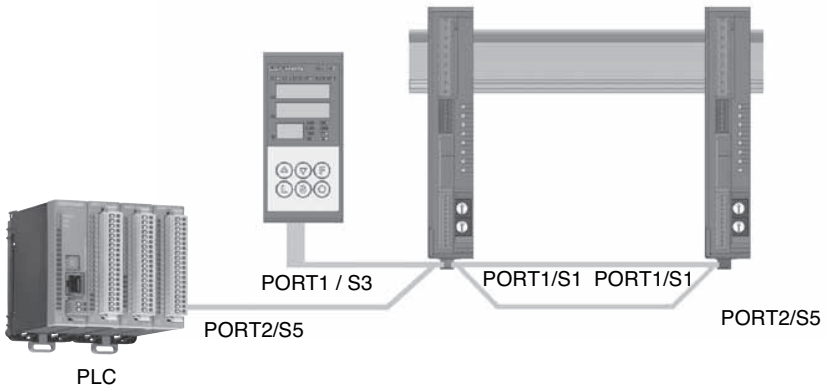
A. Supervisory PC/PLC with multiple C4X Modules, with C4-OP.
May need to use Autobaud to synchronize communications.

B. HMI Connection via Modbus RTU (RS-485) to four C4X Modules
May need to use Autobaud function to synchronize communications.

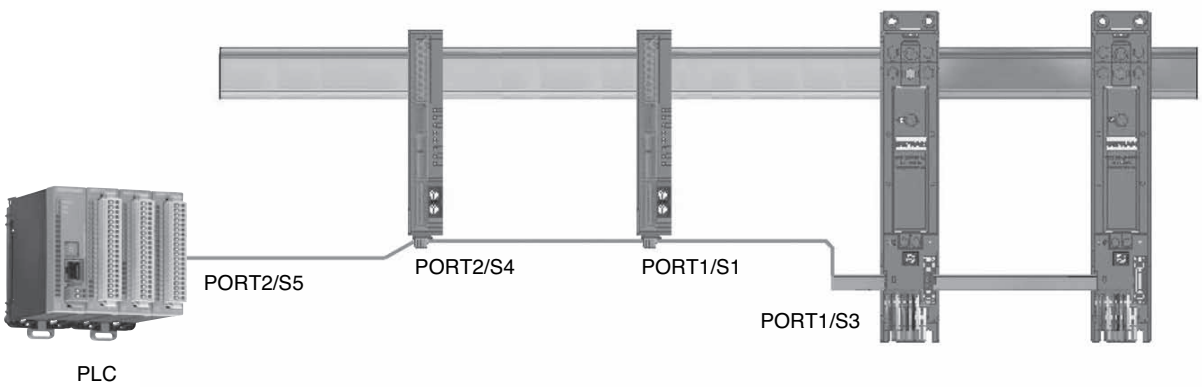
C. Integration of C4X with C4 Series modules connected in RS485 Modbus



Supervision from PC/PLC simultaneous with C4-OP configuration terminal (each module must have a fieldbus interface)



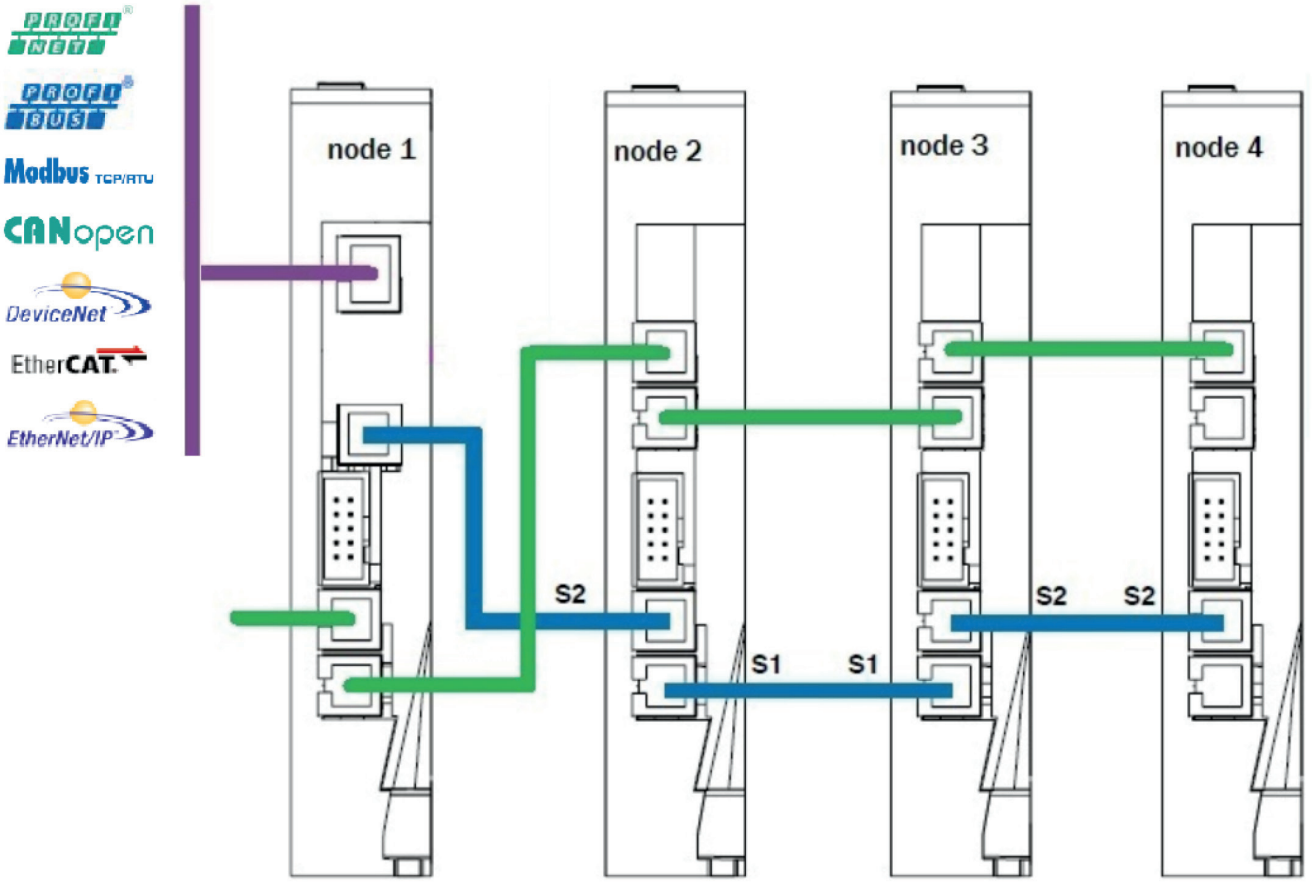
Supervision from PC/PLC via a single module equipped with fieldbus interface



D. C4X with Multiple Master Communications Ports

This configuration will allow two masters to simultaneously operate. This will allow the fieldbus to operate, while allowing the 2nd port to be used for local information, verification of process, or for configuration tool C-PWR software to be utilized.

Use Autonode to set communications.



C4X Fieldbus Network

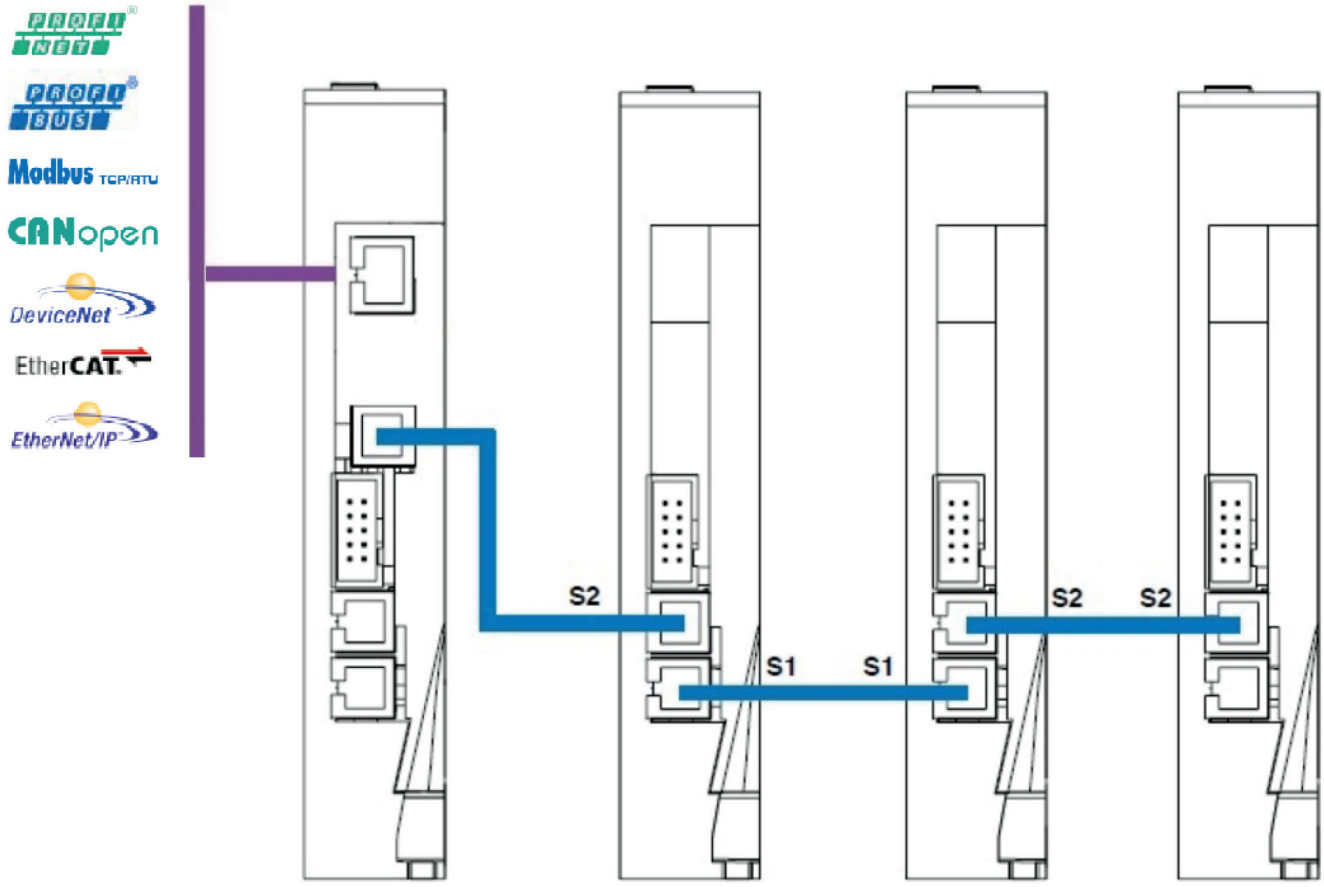
Purple: Fieldbus Network wiring to Master Unit.
SW7 must be set to “off” on all units.

Blue: Fieldbus Network Slave Unit connection via RS-485.

Green: 2nd Master Communications Port for local master or configuration using C-PWR Software

E. C4X with a Single Master Communication Port

Use Autonode Sequence for configuration. See section 12.2



C4X Fieldbus Network

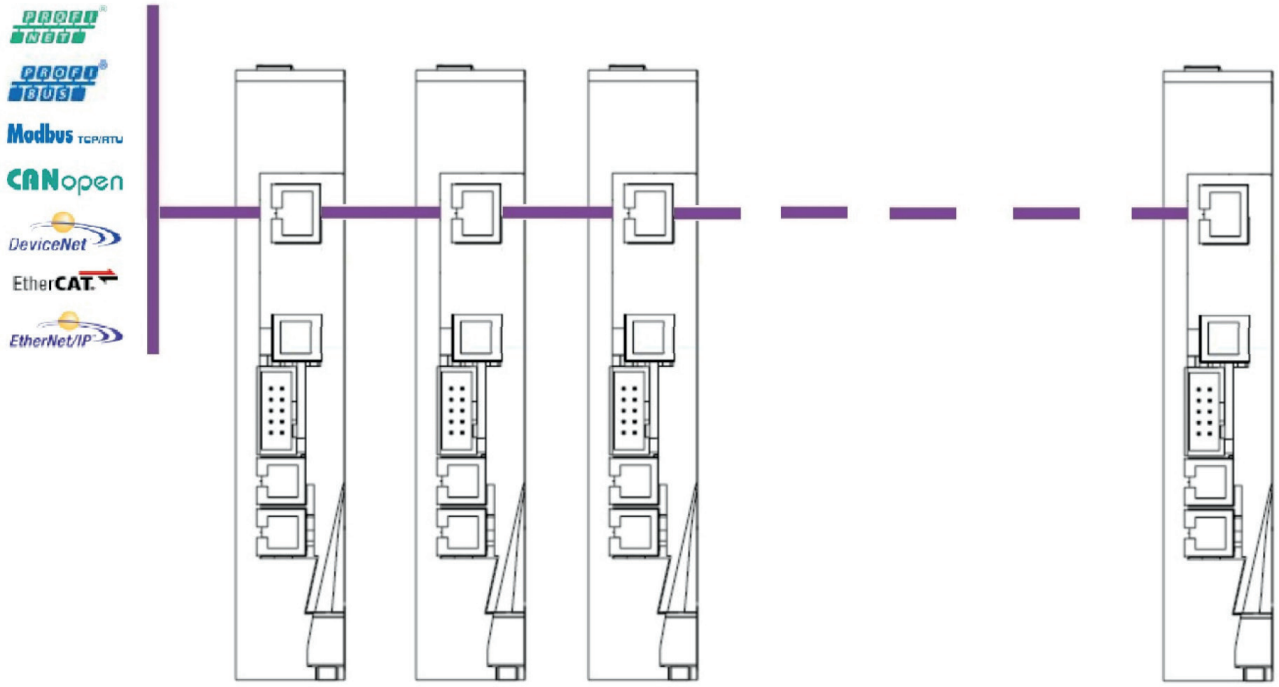
Purple: Fieldbus Network wiring to Master Unit.
SW7 must be set to “off” on all units.

Blue: Fieldbus Network Slave Unit connection via RS-485.

C-PWR Configuration Tool can be used via RS-485 ports only. Fieldbus connection must be broken to utilize configuration.

Single Master systems can be expanded to two master systems in field.

F. Multiple Fieldbus Connections



C4 or C4-IR Fieldbus Network
Purple: Fieldbus Network wiring to Master Unit.
SW7 must be set to off on all units.

C4X Fieldbus Network

Purple: Fieldbus Network wiring to Master Unit. SW7 must be set to “off” on all units.

6. Communications Port (Modbus RTU/RS485)

A network typically has a Master that “manages” communication by means of “commands,” and Slaves that carry out these commands.

C4X modules are considered Slaves to the network master, which is usually a supervision terminal or a PLC.

They are positively identified by means of a node address (ID) set on rotary switches (tens + units).

A maximum of 99 C4X modules can be installed in a serial network, with node address selectable from “01” to “99” in standard mode or can also create a network with C4X and C4 Series mixed in C4 Series compatible mode, in which each C4X identifies 4 zones with sequential node address starting with the code set on the rotary switches.

C4X modules have a ModBus serial (Serial 1) and, optionally (see order code) a Fieldbus serial (Serial 2) with one of the following protocols: Modbus RTU, Profibus DP, CANopen, DeviceNet e Ethernet Modbus TCP.

The MODBUS RTU port 1 has the follwing factory settings (default):

Parameter	Default	Range
ID	1	1...99
BaudRate	19.2kbits/s	1,2...57.6k bits/s
Parity	None	Parity/Odd Parity/None
StopBits	1	-
DataBits	8	-

The following procedures are indispensable for the Modbus protocol. For the other protocols, see the specific C4 Series manuals.

The use of rotary switches (A...F) letters is for particular procedures described in the following paragraphs.

Here are the tables showing them:

Procedures	Position of Rotary Switches		Description
	Tens	Units	
AutoBaud	0	0	It enables to set the correct BaudRate Value
AutoNode*	A	0	It enables to transfer the correct node (ID) address (tens)

7. Autobaud Function

7.1 Autobaud Port 1 Sequence

Configures serial communications speed and parity of the C4 modules to the connected PLC, HMI, or PC. If a fieldbus card (port 2) is used then port 1 settings must remain at factory settings.

Function

Adapt the serial communication speed and parity of the C4X modules to the connected supervision terminal or PLC.

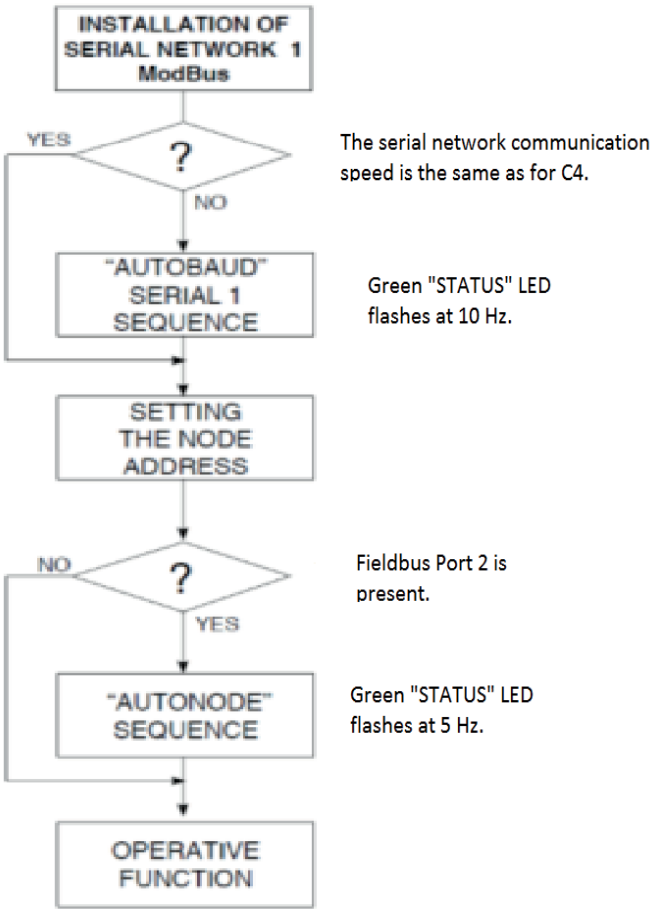
Green LED L1 “STATUS” mentioned in the procedure can vary its behavior based on parameter Ld.1, which is set to a default value of 16.

Procedure

1. Connect the serial cables for all modules on the network to serial 1 and to the supervision terminal.
2. Set the rotary switch on the C4X modules to be installed, or on all modules present in case of first installation, to position “0+0”.
3. Check that the green “STATUS” LEDs flash at high frequency (10Hz).
4. The supervision terminal must transmit a series of generic “MODBUS” read messages to the network.
5. The procedure is over when all of the green L1 “STATUS” LEDs on the C4X modules flash at a normal frequency (2Hz) (if parameter 197 Ld. 1 = 16 as default).

The new speed parameter is saved permanently in each C4X; therefore, the “AUTOBAUD SERIAL 1” sequence does not have to be run at subsequent power-ups.

When the rotary switch is turned, the green “STATUS” LED stays on steadily for about 6 seconds, after which it resumes.



7.2 Autonode Sequence for Fieldbus Use

Function

Autonode should be run for all field bus installations.

The L1 “STATUS” green LED mentioned in the procedure can vary its behavior according to the Ld.1 parameter which is 16 as default.

Procedure

1. Connect the serial cables to all the module in the serial 1 network, disconnect supervision or C4X terminals.
2. Turn the rotary switches from the set node address to the position “A + 0”.
3. Check that the “STATUS” green LED is blinking at an average frequency (5Hz) for 10 seconds and then that it returns to normal blinking (2Hz).
4. Turn the rotary switches in the position of the node address.

8. Specifications

INPUTS	
IN1,…,IN4 analog process inputs	
Function	Acquisition of process variable
Max. Error	0,2% f.s. ± 1 scale point at room temperature of 25°C
Thermal drift	< 100 ppm/°C f.s.
Sampling time	120 ms
Thermocouple Tc (ITS90)	J,K,R,S,T (IEC 584-1 ,CEI EN 60584-1, 60584-2) Fault cold junction comp 0,1°/°C
Resistance thermometer RTD (ITS90)	Pt1 00 (DIN 43760) MMax line resistance 20ohm
Voltage	linear: 0, . .. ,60mV, Ri>1 Mohm 0, ... , 1V, Ri> 1 Mohm a 32 segment custom linearization can be inserted
Current	Linear: 0/4 ... 20mA, Ri =50ohm a 32 segment custom linearization can be inserted
IN5, ... ,1N8 Auxiliary Analog Inputs (option)	
Function	Acquisition of variables
Accuracy	1% f.s. + 1 scale point at room temperature of 25°C
Sampling time	480 ms
Thermocouple Tc (ITS90)	J,K,R,S,T (IEC 584-1, CEI EN 60584-1, 60584-2) Fault cold junction comp 0,1°/°C
Voltage	linear: 0, ... ,60mV, Ri>1 Mohm
IN9, ... IN12 Inputs Internal Current Transformers CT	
Function	Read internal CTs; (The acquisition of current values is valid for voltages in a range of 90 ... 530Vac)
Accuracy	1% f.s. ± 1 scale point at room temperature of 25°C
Sampling time	60 ms
DI1 ... DI2 Digital Inputs	
Function	Configurable (default: disabled)
Type	PNP, 24 VDC, 8mA 3500V isolation
OUTPUTS	
OUT1, ... , OUT4 Heat Control Outputs Connected Directly to Solid State Power Units	
Function	Configurable (default: heat control) Control state is displayed by LED (O1 , . .. ,O2)
OUT5, ... , OUT8 Cool Control Outputs (option)	
Function	Configurable (default: cool control)
Relay Type	3A NO Contact, 250V/30Vdc $COS\varphi$ =1
Continuous Type	0/2 .. . 10V, (default) max 25mA protection against short circuit 0/4 . .. 20mA, max. load 500ohm 1500V isolation
Logic Type	24 Vdc, > 18V a 20mA
Triac Type	230V/max 4A AC51 (1 A for every channel)

OUT9, ... , OUT10 Alarms

Function	Configurable (default: alarms)
Relay Type	5A NO Contact, 250V/30Vdc COSφ =1

COMMUNICATIONS

PORT 1 (present)

Function	Local serial communication
Protocol	ModBus RTU
Baudrate	Settable to 1,2...57.6kbits/s, (default 19.2 kbit/s)
Address	Node Settable by rotary switch
Type	RS485 1500V isolation, double connector RJ10 telephone type 4-4

PORT 2 (Fieldbus Option)

Function	Fieldbus serial communication
Protocol	ModBus RTU, type RS485, baudrate 1,2...57.6 kbit/s CANOpen 10K….1Mbit/s DeviceNet 125K...0.5Mbit/s Profibus DP 9.6K...12 Mbit/s Ethernet Modbus TCP, Ethernet IP 10/100Mbps EtherCAT, ProfiNET 100Mbps

FUNCTIONS

Safety	Detects short circuit or open probe circuit, probe, power supply failure, LBA alarm, HB alarm
Selection °C/°F	Configurable
Linear scale range	-1999 ... 9999
Control Actions	4 control loops: Double action (heat/cool) PID, on-off Self-tuning at power-up, Continuous Autotuning, One-shot Autotuning
pb-dt-it	0,0 ... 999,9 % - 0,00 ... 99,99 min - 0,00 ... 99,99 min
Action - Control Outputs	heat/cool - ON/OFF, PWM, GTT
Heat/Cool Max. Power Limitation	0,0 ... 100,0%
Cycle Time – Softstart	0 ... 200 s - 0,0 ... 500,0 min Softstart at phase slicing
Fault Power Setting	-100,0 ... 100,0%
Shut-Down Function	Maintains sampling of process variable PV; when active, disables control
Configurable Alarms	Alarm is assigned to an output, configurable as: maximum, minimum, symmetrical, absolute/deviation, LBA, HB
Alarm Masking	Exclusion at power-up, latch, reset by digital input
Diagnostics	SCR in short circuit (presence of current with control OFF) SCR open (presence of voltage on SCR with control ON) Load interrupted or no voltage (no current, no voltage on SCR with control ON)
Connection and Load Types Selection with Dip-Switches	4 loads single-phase, 2 loads 3-phase, star without neutral controlled on two phases 2 loads 3-phase, closed triangle controlled on two phases 1 load 3-phase, star with neutral controlled on one phase 1 load 3-phase, open triangle controlled on one phase (with 3-phase load, 4 CTs are needed if diagnostics is required)

GENERAL DATA	
Power Supply	24VDC +/-25%, max 8VA
Indicators	Eight LEDS: RN CPU in run state ER Fault Signal DI1, DI2 state of digital inputs O1,...O4 state of outputs
Protection	IP20
Work/Storage Temperature	0 - 50˚C (see dissipation curves) / -20˚C...70˚C
Relative Humidity	20 - 85% RH non-condensing
Ambient Work Conditions	Indoor use, altitude up to 2000m
Installation	DIN RAIL EN50022 or panel using screws
Installation Instructions	Installation category II, Pollution level 2, double isolation Max surrounding air temperature 50˚C (for UL) Open type equipment
Weight(s)	0.7lbs (320g)

9. Ordering Information

Model	C4X SCR Power Controller
C4X	The C4X Series Multiple Zone SCR Power Controller manages both single phase and 3-phase industrial heating load applications. Load management options include: Up to 4 independently controlled single phase loads or one 3-phase/3-leg load (with or without an additional single phase load) or up to two 3-phase/2-Leg loads. Standard features: Four universal main process inputs, two digital inputs, two configurable alarm outputs, Modbus RTUIRS485 digital communications, DIN Rail/Panel mountable. Optional features: Input for four current transformers, four analog inputs, four configurable outputs, several Fieldbus Communication protocols. Approvals: CE, cULus

Code	Auxiliary Outputs
0	None
R	Relay
D	Logic
A	Analog
T	Triac

Code	Auxiliary Inputs
0	None
2	4 Current Transformers
4	4 Linear Inputs (See Note 1)

Code	Second Fieldbus Option
00	None
MR	Modbus RTU (RS485)
ET	Modbus TCP/Ethernet
ER	Ethernet Real Time IP,[1]
PB	Profibus DP
PN	ProfiNET[1]
EC	EtherCAT[1]
CN	CANopen
DN	DeviceNet
EM	Euromap 66

C4X-	**D**	**4**	**00**	**Typical Model Number**

[1]Not available with EC, PN & ER Fieldbus Codes.

10. Configuration and Programming

10.1 C-PWR Configuration Software Program

See C-PWR Configuration Software Program instruction manual for proper program installation.

10.2 C4/C4X Programming Manual

See C4/C4X Programming Manual for complete controller set-up of communications, inputs, outputs, alarms and control modes.

11. Accessories

11.1 Fieldbus Cards

Fieldbus Type	Part No.	Model No. (Fieldbus Card)	Manufacturer's Model Code	Description
Modbus RTU	0149-50103	C4-MOD	F032357	Card for Modbus RTU protocol (serial 2)
Profibus DP	0149-50104	C4-PROFI	F032358	Card for Profibus DP protocol (serial 2)
CANopen	0149-50105	C4-CAN	F032359	Card for CANopen protocol (serial 2)
DeviceNet	0149-50106	C4-DNET	F032360	Card for DeviceNet protocol (serial 2)
Modbus TCP/IP	0149-50107	C4-ETH	F033532	Card for Ethernet Modbus TCP protocol (serial 2)
EtherCat	0149-50108	C4-ETH2	F049411	Card for EtherCat protocol (serial 2)
Profinet	0149-50109	C4-ETH4	F054949	Card for Profinet protocol (serial 2)
Ethernet IP (Real-Time)	0149-50110	C4-ETH5	F058234	Card for Real Time Ethernet/IP protocol

11.2 Additional Spare Parts

Part No.	Manufacturer's Model Code	Description
0149-50099	F032861	Connection cable for serial Modbus (RJ10) 0.3M
0149-50100	F032862	Connection cable for serial Modbus (RJ10) 1M
0149-50101	F032863	Connection cable for serial Modbus (RJ10) 2M
0149-50102	F032864	Connection cable for serial Modbus (RJ10) 5M
0149-50115	COUT4-9	9-Terminal Connector (J1) For C4 Controller
0149-50116	COUT4-4	4-Terminal Connector (J1a) For C4 Controller
0149-50117	CSIG4-7	7-Terminal Connector (J2) For C4 Controller
0149-50118	CSIG4-12	12-Terminal Connector (J4) For C4 Controller
0149-50119	CSIG4-4	4-Terminal Connector (J3a) For C4 Controller

11.3 Configuration Software and Cabling

Configuration kit for C4X product line by means of PC with USB (Windows environment). Software is compatible with all C4X models. Download free at www.Chromalox.com

- Allows you to read and write all of the parameters of a single C4X device
- Easy and rapid configuration
- Saving and management of parameter recipes
- On-line trend and saving of historical data

Description	Part No.
Communication Cable, USB to TTL	309171
Communication Cable, USB to RS485	309180

11.4 C4-OP

Operator terminal for in-field configuration of the entire C4X product line.

Two types of terminals: - for installation on DIN guide
- for panel installation

See C4-OP Hardware Manual for more details.

Limited Warranty:
Please refer to the Chromalox limited warranty applicable to this product at http://www.chromalox.com/customer-service/policies/termsofsale.aspx.

Chromalox, Inc.
1347 Heil Quaker Boulevard
Lavergne, TN 37086
(615) 793-3900
www.chromalox.com