SPECTRUM Discrete Input Interface Operating Instructions

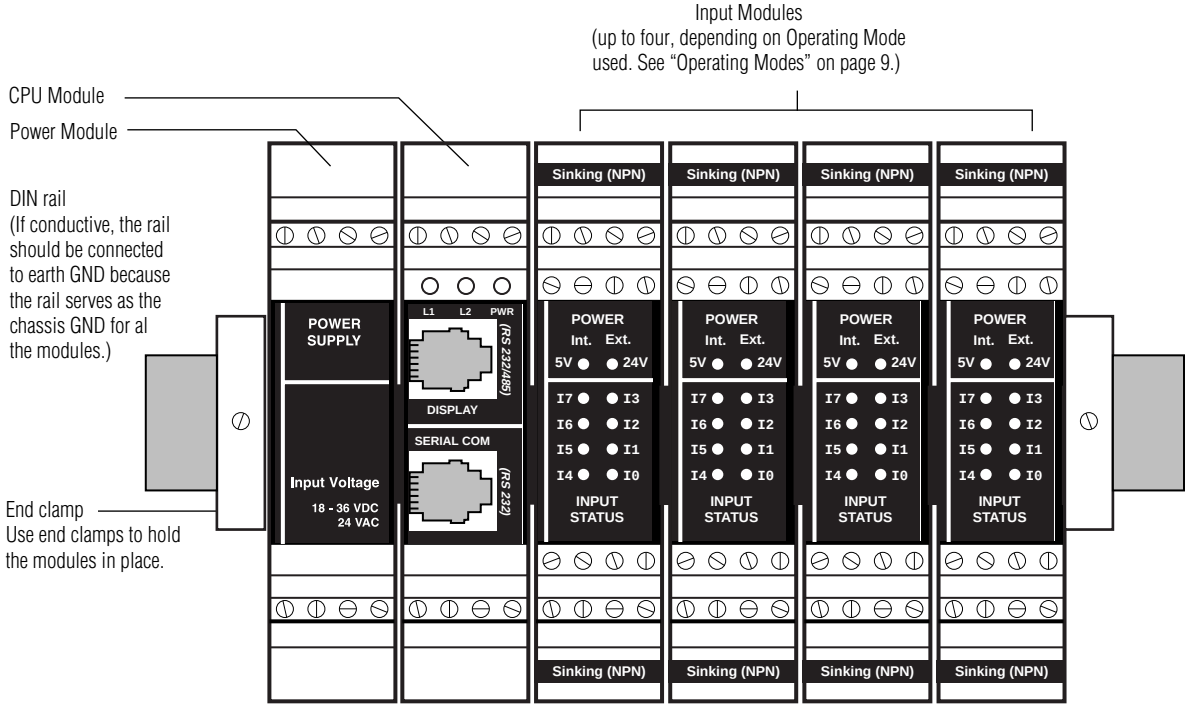
Introduction

The SPECTRUM Discrete Input Interface allows messages to be displayed on standard SPECTRUM Message Signs by using simple on/off contacts to trigger messages that have been stored in a Message Sign. The SPECTRUM Discrete Input Interface is designed for low-voltage applications.
Messages to be displayed are stored in a Message Sign using either:

- Infrared handheld remote control
- SPECTRUM software such as SPECTRUM Messaging software (see "Creating messages using SPECTRUM Messaging software" on page 23)

The SPECTRUM Discrete Input Interface consists of three types of modules which can be connected in any order:

- CPU Module — serves as an interface between the Input Modules and SPECTRUM Message Signs.
- Input Module (up to four can be used, depending on the Operating Mode used) — the eight, dry contact inputs of each Input Module can be configured to one of five possible Operating Modes (see "Operating Modes" on page 9):
  - — Mode Ø: Discrete Fixed
  - — Mode 1: Momentary Triggered
  - — Mode 2: Binary Coded Decimal (BCD)
  - — Mode 3: Binary
  - — Mode 4: Counter
- Power Module — supplies power to the CPU Module and Input Modules



NOTE: Modules should be mounted in an appropriate NEMA enclosure to ensure isolation from noise and protection from harsh environments.

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Related documentation

Title	Description
Network Configuration Manual	Detailed information on how to network SPECTRUM Message Signs.
SPECTRUM Remote Control Programming Manual	Examples of how to program messages into SPECTRUM Message Signs using a handheld infrared remote control.
SPECTRUM Messaging Software User Manual v1.Ø	Instructions on using the SPECTRUM Messaging software to program messages into SPECTRUM Message Signs.

Technical specifications

All Modules	
Dimensions:	2.75"W x 4.25"H x 1"D
Weight:	4 oz per module
Operating temperature:	60°C
Humidity range:	10 – 95% non-condensing
Mounting:	DIN rail 35 x 7 mm
Power Module	
AC input voltage[1]	
Max. AC voltage:	25 Vrms
Min. AC voltage:	14 Vrms
Power consumption:	15W @ 24 Vrms
DC input voltage	
Max. DC voltage:	36 VDC
Min. DC voltage:	18 VDC
Output voltage 24 VDC	
Max. voltage:	36 VDC
Min. voltage:	18 VDC
Max. current:	700 mA
Bus output voltage 5 VDC	
Max. voltage:	5.05 V
Min. voltage:	4.95 V
Max. current:	500 mA
Protection	
Type	Polyswitch
Self-resetting:	Yes
Terminals	
Type:	Screw
Wire size:	0, 14-2, 5[2]/ AWG 26 - 14
CPU Module	
Operating voltage:	5 V
Current draw:	150 mA
Power consumption:	0.75 W
Communications	
Serial (in):	Communication type: RS232 Terminal type: RJ11 Protocol: EZ95

Display (out):	Communication type: RS485 Terminal type: RJ11 Protocol: EZ95
Terminals (out):	Communication type: RS485 Terminal type: Screw Wire size: 0, 14-2, 5 [2]/ AWG 26 - 14 Protocol: EZ95 Max. number of drops: 32 Max. distance: 4000 ft (1200 m)
Input Module	
Bus power required (5 VDC)	
Max. operating voltage:	5.05 V
Min. operating voltage:	4.95 V
Max. current:	15 mA
Input power required (24 VDC)	
Max. operating voltage:	36 VDC
Min. operating voltage:	18 VDC
Max. current:	90 mA
Min. current:	5 mA
Inputs per module:	8
Discrete fixed:	8
Discrete momentary:	8
BCD:	8
Binary:	7
Counter:	3 (min.)
Protection:	Polyswitch, 300 mA
Terminals:	
Type:	Screw
Wire size:	0, 14-2, 5 [2]/ AWG 26 - 14
Input impedance:	3600 ohms
Max. input voltage:	36 VDC
Min. input voltage:	18 VDC
Max. current draw:	3.5 mA (36 V)
Min. current draw:	4.1 mA (18 V)
[1] Only one power supply, 18 – 36 VDC or 24 VAC, can be used to power this product.	

Installation

1. Determine the type of Operating Mode to be used and set the internal Input Module jumpers as required. See "Operating Modes" on page 9.
2. Determine the circuit type (i.e., Sinking or Sourcing) to be used and wire the circuit for the modules as required. See "Operating Modes" on page 9.
3. Determine the content of the messages to be displayed on the SPECTRUM Message Sign(s). Then create the messages and store them on the Message Sign(s). See "Creating messages using SPECTRUM Messaging software" on page 23.

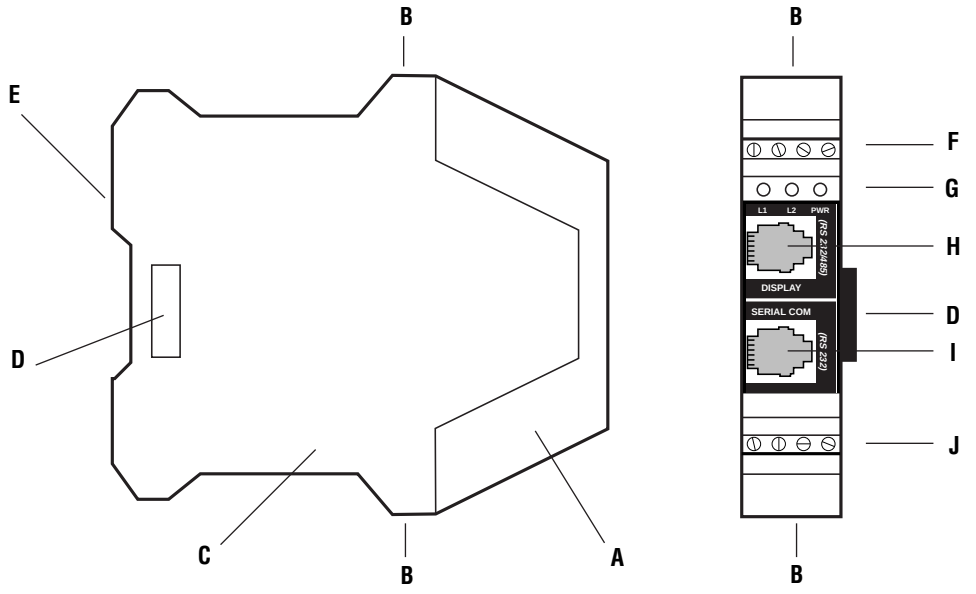
Module descriptions

NOTE: Always remove power from a module before changing wiring or jumper settings. Failure to do so may damage the equipment.

NOTE: Parts are not serviceable on any of the modules. In case of malfunction, return to the manufacturer.

CPU Module

NOTE: Only one CPU Module can be used at a time. See "Operating Modes" on page 9.

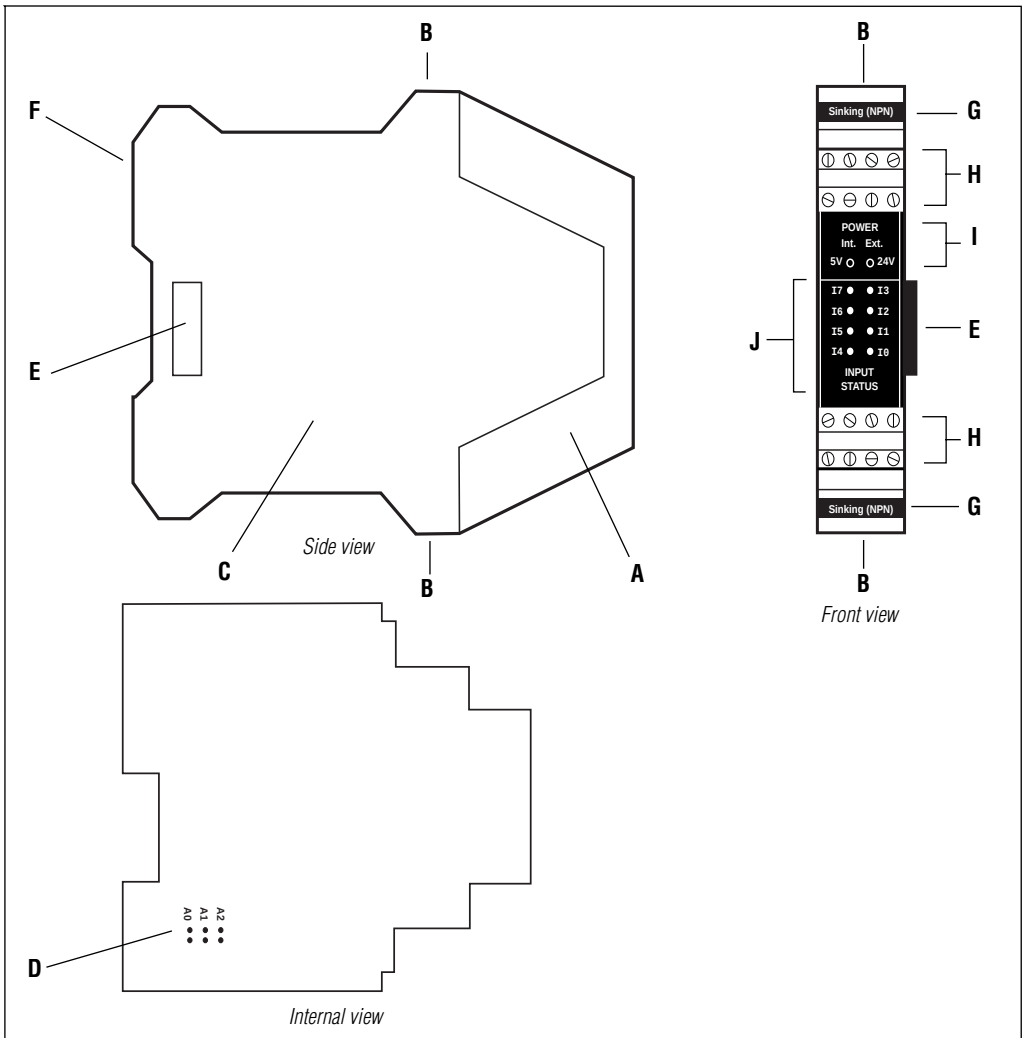


Side view *Front view*

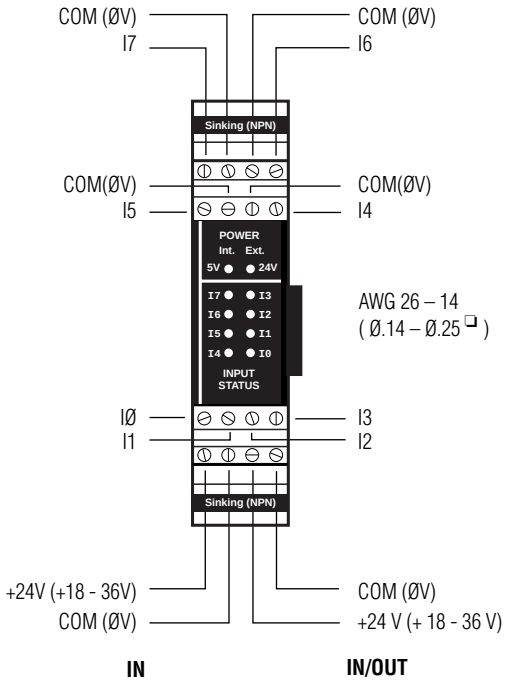
Item	Name	Description
A	Module Top	The internal PCB is attached to the Module Top.
B	Release Button	Depress each Release Button to remove the Module Bottom.
C	Module Bottom	Can be removed to expose internal PCB.
D	Intermodule Connector	Used to pass power and signals between modules. When attached to a conductive DIN rail, the rail serves as the CHASSIS GND for all modules connected to the DIN rail.
E	DIN rail latch	Used to attach the module to a DIN EN 5Ø Ø22 mounting rail.
F	Serial Output	*Shield RS485 output to one or more SPECTRUM Message Signs.* **Because of the signal protection afforded by shielding, this is the recommended way of connecting SPECTRUM Message Signs to the CPU Module.** To connect SPECTRUM Message Signs, see "Creating messages using SPECTRUM Messaging software" on page 23. SHLD (Shield) GND (–) RS485 (+) RS485 For *shielded RS485 output,* use SHLD with (–) RS485 and (+) RS485. AWG 26 – 14 (Ø.14 – Ø.25 ❑) L1 L2 PWR

G	CPU Status Indicators	**PWR** — When lit, this indicates the unit is powered. **L1** — Lit during power up until the CPU Module initializes. If *indicator on continuously* after power up, this indicates that the power source is not sufficient. If *indicator flashing continuously,* this indicates one of four possible conditions: • no Input Module is connected • too many Input Modules are attached for the current Operating Mode • Input Modules are set to different Operating Modes • an Input Module has failed or a communication failure to an Input Module has occurred If *indicator flashes once*, this means that the binary input is greater than or equal to 80 or that count is either < -2,147,483,647 or > +2,147,483,647. **L2** — During power up, L1 and L2 flash together X+1 times, where X = Mode number (Ø - 4). During normal operation, L2 flashes when the CPU Module is processing an input event.
H	DISPLAY	*Unshielded RS485 output to a single* SPECTRUM Message Sign. Used to: • program messages into a Message Sign • trigger messages already in a Message Sign **This is not a telephone connector.**
I	SERIAL COM	*RS232 input* from a PC. Used to program messages and send them to a CPU Module that is *up to 5Ø feet from the PC.* **This is not a telephone connector.**
J	Serial Input	Unused.

Input Module

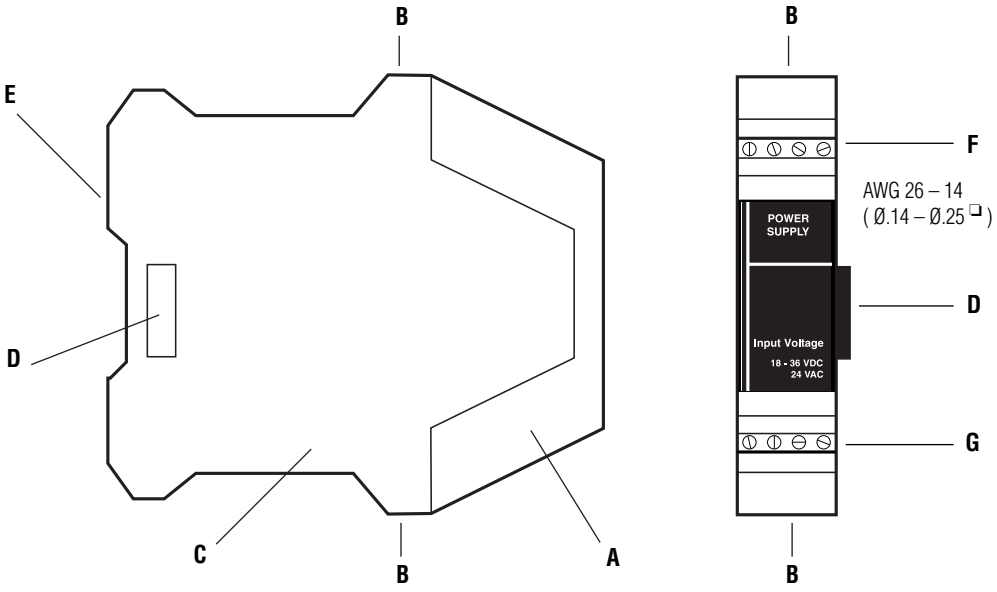


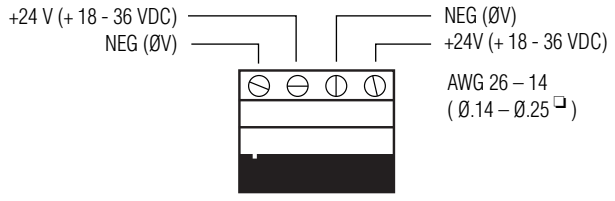
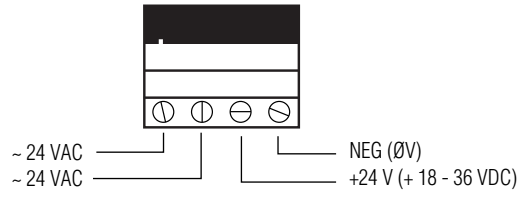
Item	Name	Description
A	Module Top	The internal PCB is attached to the Module Top.
B	Release Button	Depress each Release Button to remove the Module Bottom.
C	Module Bottom	Can be removed to change jumpers on the internal PCB.
D	Internal Jumpers	The AØ, A1, and A2 internal jumpers are used to set the Operating Mode and Input Module Address. (See "Operating Modes" on page 9.) **NOTE:** Spare jumpers are included inside each Input Module.
E	Intermodule Connector	Used to pass power and signals between modules.
F	DIN rail latch	Used to attach the module to a DIN EN 5Ø Ø22 mounting rail.
G	Type of Input Module	Input Modules are configured for either Sinking (NPN) or Sourcing (PNP) current applications.

H	Input Terminals	
I	Power Indicators	**Int.** — When lit, this indicates that a power source is present. **Ext.** — When lit, this indicates that an external 24 VDC power source is present.
J	Input Status Indicators	When lit, this indicates activity from an input (IØ – I7).

Power Module

NOTE: Only one Power Module can be used at a time. See "Operating Modes" on page 9.

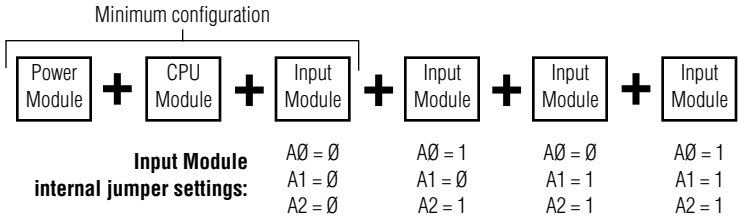
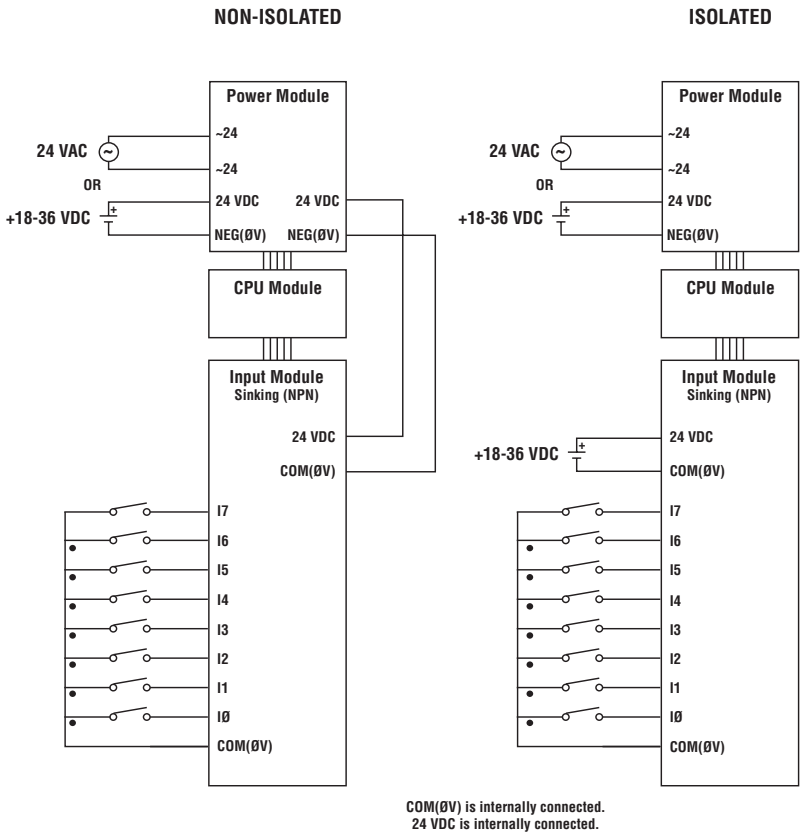


Item	Name	Description
A	Module Top	The internal PCB is attached to the Module Top.
B	Release Button	Depress each Release Button to remove the Module Bottom.
C	Module Bottom	Can be removed to expose the internal PCB.
D	Intermodule Connector	Used to pass power and signals between modules.
E	DIN rail latch	Used to attach the module to a DIN EN 5Ø Ø22 mounting rail.
F	Power Output	
G	Power Input	

Operating Modes

NOTE: Only one Operating Mode can be used at a time. For example, if three Input Modules were connected together, *all three* modules would have to use the *same* Operating Mode.

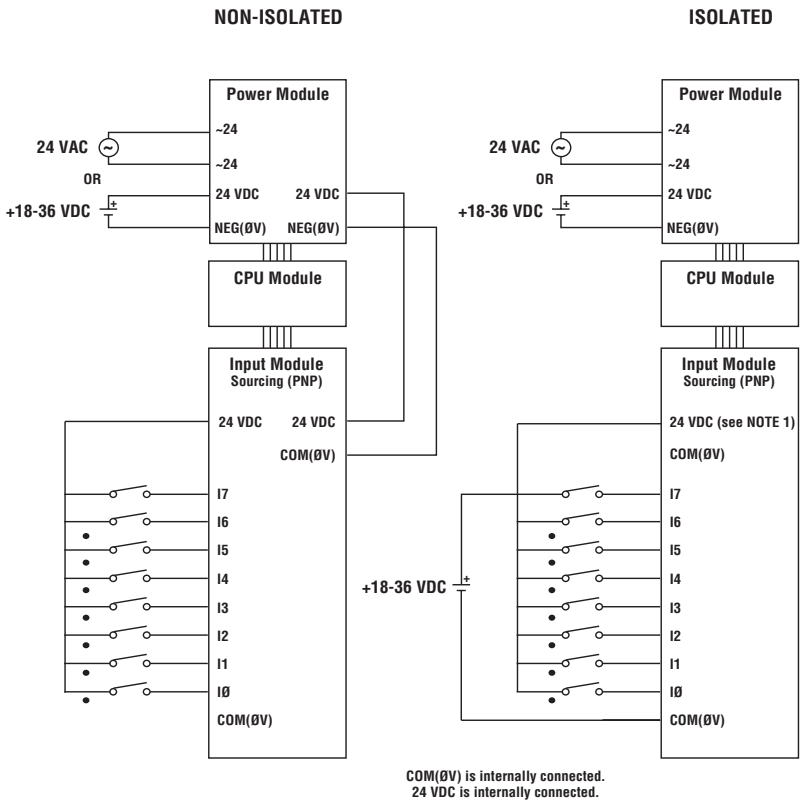
Discrete Fixed (Mode Ø)

Description:	When an input (IØ - I7) is high, the associated Message Sign message is displayed. It is possible to have several messages running simultaneously on a Message Sign.
Module configuration: (modules can be connected in any order)	
Maximum no. of messages:	32
Maximum no. of inputs:	32 (8 inputs per module x 4 Input Modules connected)
Sinking (NPN) circuit:	

NOTE: All Input Modules are internally fused. Also, the Power Module is internally fused.

NOTE: Wire the modules according to local electrical code.

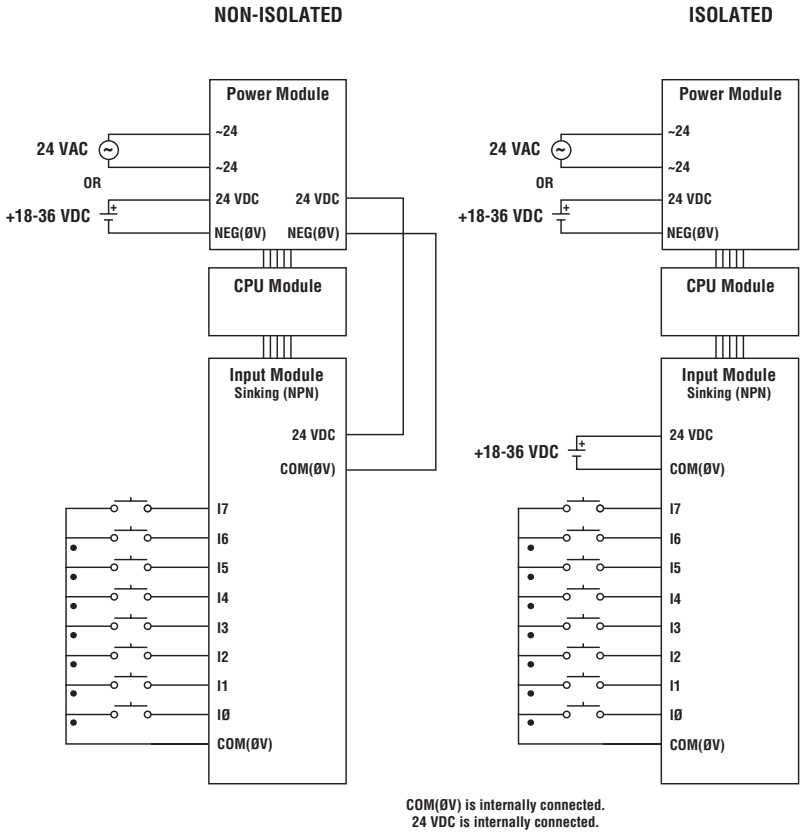
Sourcing (PNP) circuit:



NOTE: All Input Modules are internally fused. Also, the Power Module is internally fused.

NOTE: Wire the modules according to local electrical code.

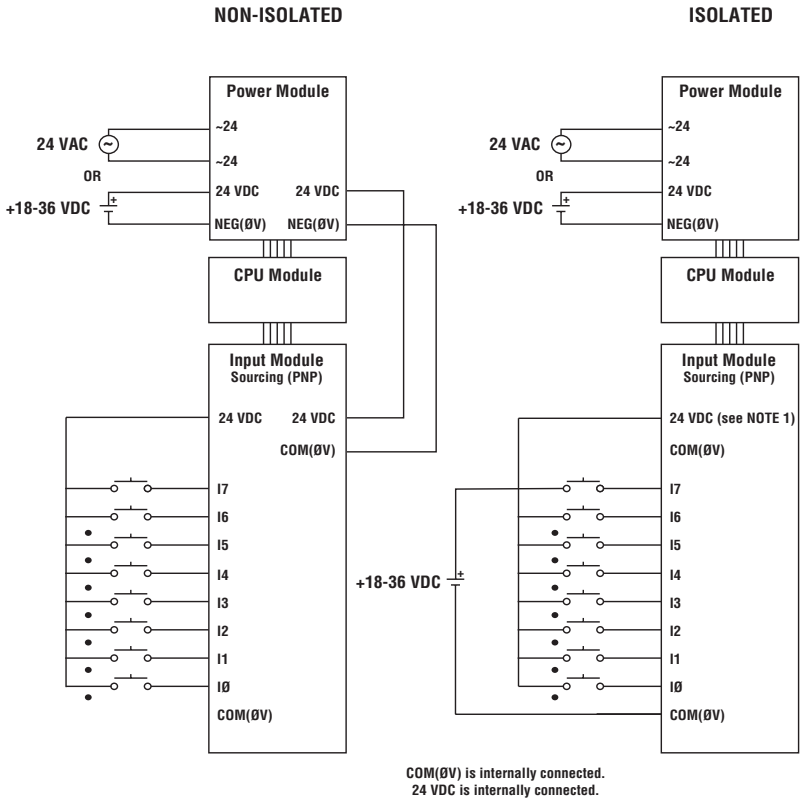
Momentary Triggered (Mode 1)

Description:	When an input (IØ - I7) goes to a high state (i.e., rising edge), the associated Message Sign message is displayed until a new message is triggered.
Module configuration: (modules can be connected in any order)	Minimum configuration Power Module + CPU Module + Input Module + Input Module + Input Module + Input Module **Input Module internal jumper settings:** AØ = 1, A1 = Ø, A2 = Ø / AØ = 1, A1 = Ø, A2 = 1 / AØ = Ø, A1 = 1, A2 = 1 / AØ = 1, A1 = 1, A2 = 1
Maximum no. of messages:	32
Maximum no. of inputs:	32 (8 inputs per module x 4 Input Modules connected)
Sinking (NPN) circuit:	

NOTE: All Input Modules are internally fused. Also, the Power Module is internally fused.

NOTE: Wire the modules according to local electrical code.

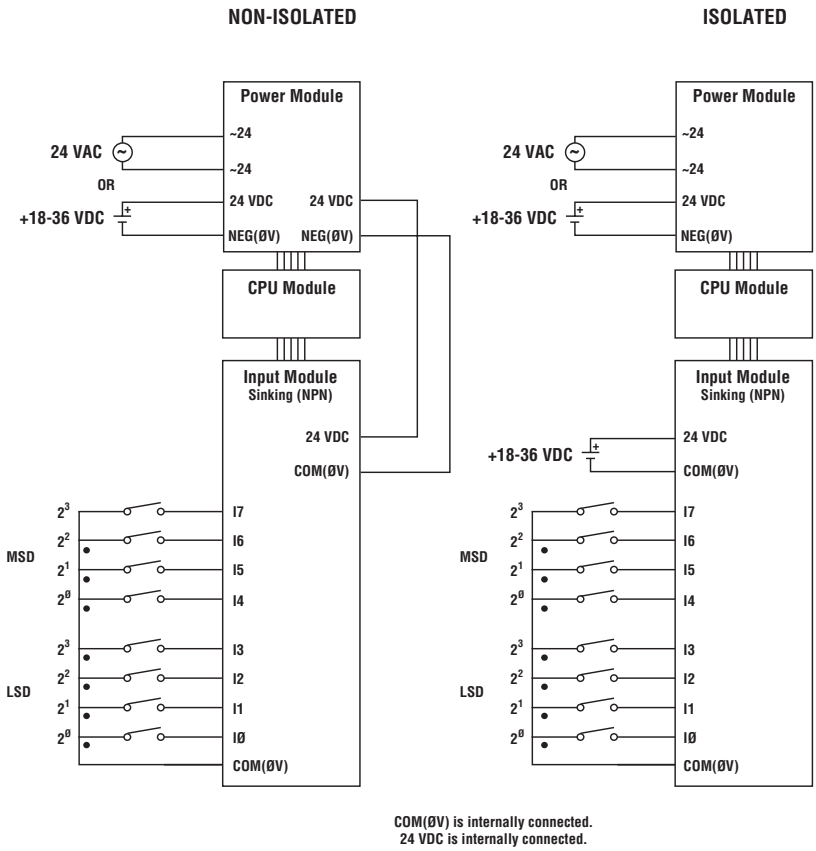
Sourcing (PNP) circuit:



NOTE: All Input Modules are internally fused. Also, the Power Module is internally fused.

NOTE: Wire the modules according to local electrical code.

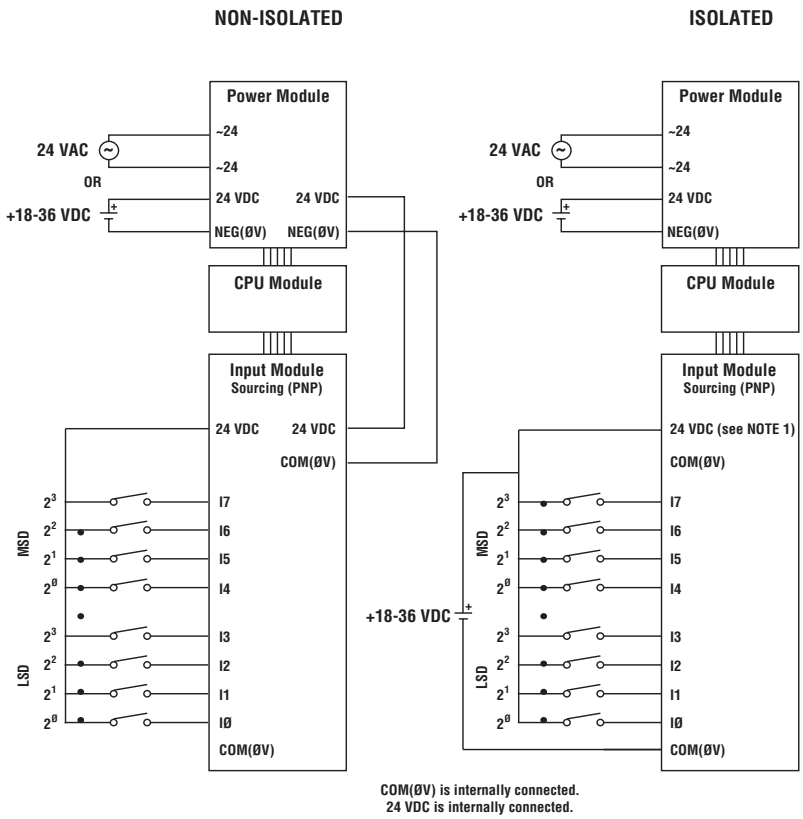
Binary Coded Decimal (Mode 2)

Description:	The BCD value read at the inputs (IØ-I7) determines the message to run (see "For BCD and Binary modes" on page 21).
Module configuration: (modules can be connected in any order)	Power Module + CPU Module + Input Module **Input Module internal jumper settings:** AØ = Ø, A1 = 1, A2 = Ø
Maximum no. of messages:	8Ø
Maximum no. of inputs:	8 (with 1 Input Module connected)
Sinking (NPN) circuit:	

NOTE: All Input Modules are internally fused. Also, the Power Module is internally fused.

NOTE: Wire the modules according to local electrical code.

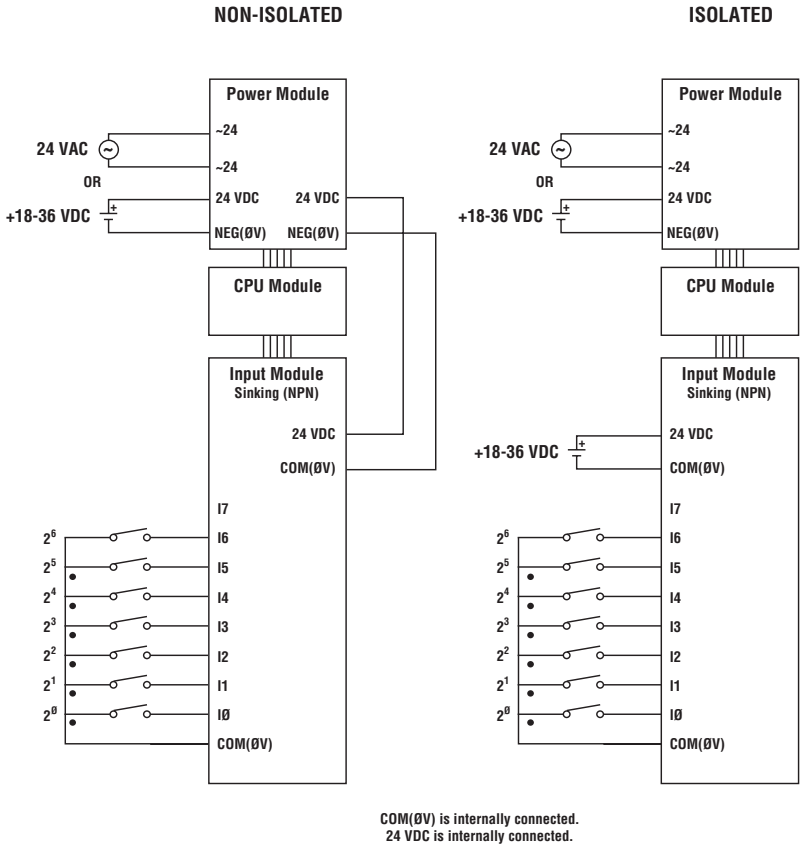
Sourcing (PNP) circuit:



NOTE: All Input Modules are internally fused. Also, the Power Module is internally fused.

NOTE: Wire the modules according to local electrical code.

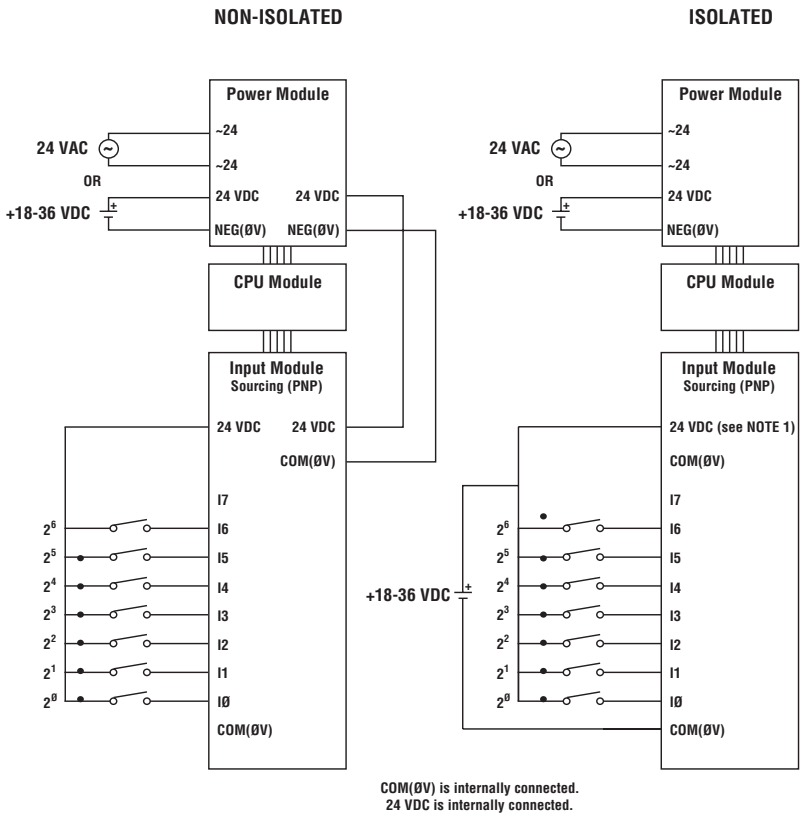
Binary (Mode 3)

Description:	The Binary value read at the inputs (IØ – I7) determines the messages to run (see "For BCD and Binary modes . . ." on page 21).
Module configuration: (modules can be connected in any order)	Power Module + CPU Module + Input Module **Input Module internal jumper settings:** AØ = 1, A1 = 1, A2 = Ø
Maximum no. of messages:	8Ø
Maximum no. of inputs:	8 (with 1 Input Module connected)
Sinking (NPN) circuit:	

NOTE: All Input Modules are internally fused. Also, the Power Module is internally fused.

NOTE: Wire the modules according to local electrical code.

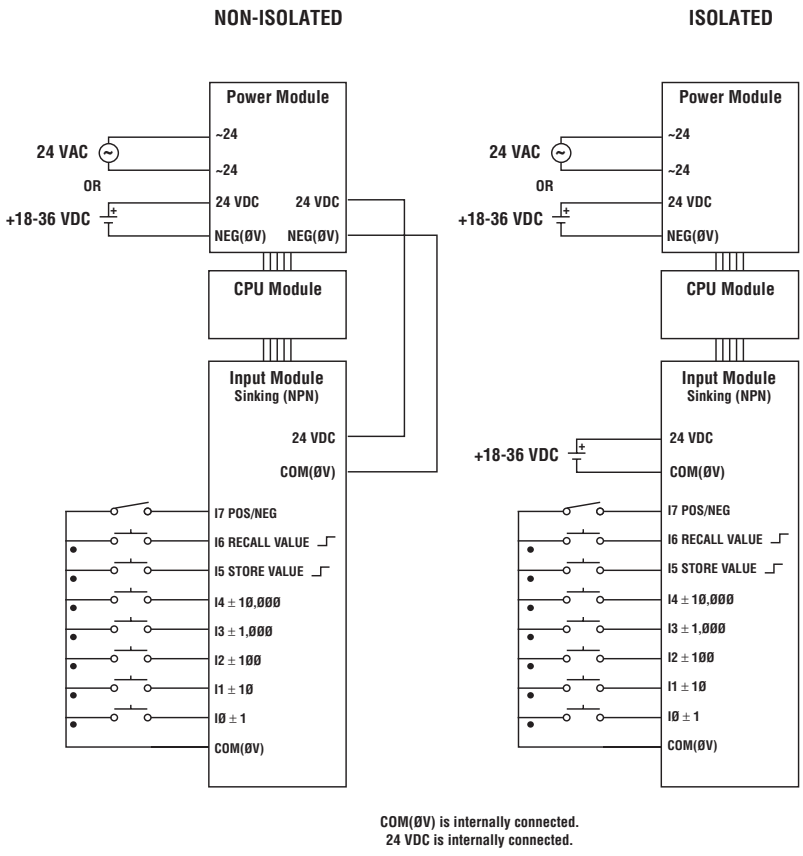
Sourcing (PNP) sample:



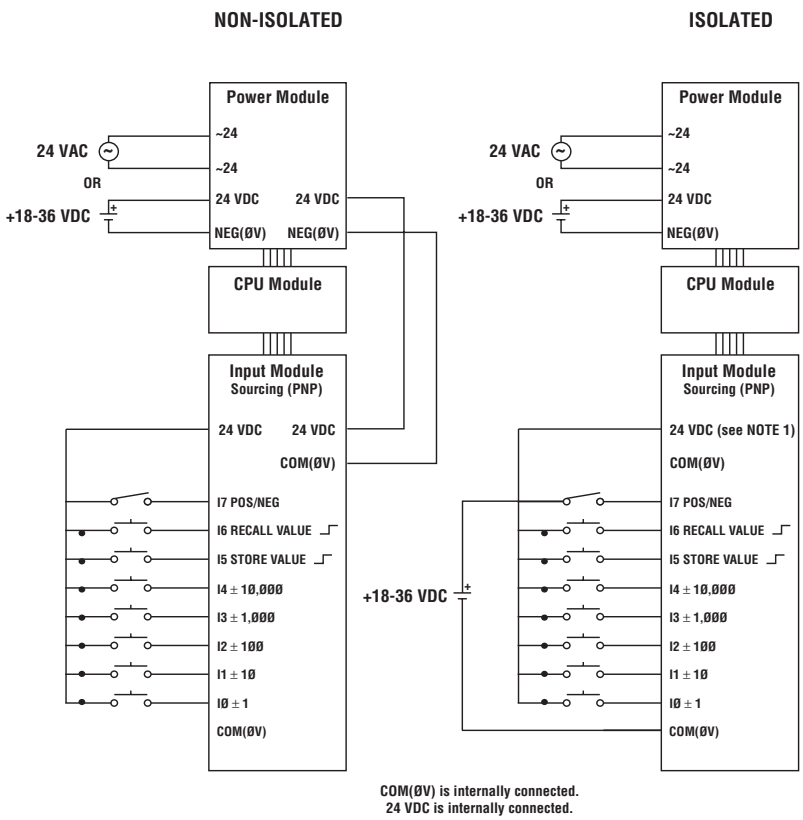
NOTE: All Input Modules are internally fused. Also, the Power Module is internally fused.

NOTE: Wire the modules according to local electrical code.

Counter (Mode 4)

Description:	This mode refreshes the Message Sign's String file "1" each time a command is processed, using the following configuration: IØ: +/– 1I5: Store current value in the CPU Module I1: +/– 1ØI6: Recall stored value from the CPU Module I2: +/– 1ØØI7: Positive/Negative number (Pos. if high, Neg. if low). I3: +/– 1ØØØMax. pos. value = +2,147,483,647. Max. neg. value = –2,147,483,647 I4: +/– 1ØØØØ
Module configuration: (modules can be connected in any order)	Power Module + CPU Module + Input Module **Input Module internal jumper settings:** AØ = Ø, A1 = Ø, A2 = 1
Maximum no. of messages:	1 (the "A" message file). **This message should be programmed using a handheld remote control, and not the SPECTRUM Messaging software.**
Maximum no. of inputs:	8 (with 1 Input Module connected)
Sinking (NPN) circuit:	 **NOTE:** All Input Modules are internally fused. Also, the Power Module is internally fused. **NOTE:** Wire the modules according to local electrical code.

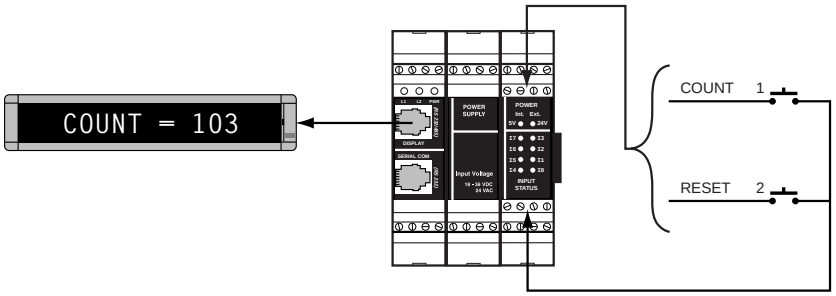
Sourcing (PNP) circuit:



NOTE: All Input Modules are internally fused. Also, the Power Module is internally fused.

NOTE: Wire the modules according to local electrical code.

Sample counter application:



Here is an example of how to use the above counter circuit:

1. Initiate Counter mode by triggering I5 and I6 at the same time for at least 5 seconds. This clears ALL messages from the Message Signs networked to the Input Module and creates an "A" message file for use as a counter. This also stores a counter value of Ø in the CPU Module.
2. Wait 1 minute before proceeding.
3. (Optional) Use a handheld remote control to edit the "A" message file. For example, if you wanted the text "COUNT =" to appear before the counter value (as shown above), use a remote control to add this text:. (A two-line Message Sign is used as an example below.)

Press **PROGRAM**:

Press **ADV** until the text stops scrolling:

Press **BACK** until [RED] is at the end of the line:

Press **INSERT.** Type: *COUNT =*. Then press **INSERT** again.

Press **ADV** again until the text stops scrolling:

Press **RUN** twice:

4. To increase the count, trigger IØ, and *COUNT = 1,COUNT = 2*, etc will appear on the Message Sign.
5. To reset the count to Ø, trigger I6.

Message numbering

For Discrete Fixed and Momentary Triggered modes . . .

IR Remote Message File Letter	SPECTRUM Messaging Software Message Number (decimal)	CPU Module Message Number (decimal)	Operating Mode: Discrete Fixed (Mode Ø) "1" = closed contact								Input Modules	Operating Mode: Momentary Triggered (Mode 1) "1" = rising edge pulse								Input Modules
			I7	I6	I5	I4	I3	I2	I1	IØ		I7	I6	I5	I4	I3	I2	I1	IØ	
"A"	1	Ø	No input = message "A" displayed on Message Sign									Message "A" will be displayed until another message is triggered. Then message "A" will not appear again.								
"B"	2	1								1	First Module								1	First Module
"C"	3	2							1									1		
"D"	4	3						1									1			
"E"	5	4					1									1				
"F"	6	5				1									1					
"G"	7	6			1									1						
"H"	8	7		1									1							
"I"	9	8	1									1								
"J"	1Ø	9								1	Second Module								1	Second Module
"K"	11	1Ø							1									1		
"L"	12	11						1									1			
"M"	13	12					1									1				
"N"	14	13				1									1					
"O"	15	14			1									1						
"P"	16	15		1									1							
"Q"	17	16	1									1								
"R"	18	17								1	Third Module								1	Third Module
"S"	19	18							1									1		
"T"	2Ø	19						1									1			
"U"	21	2Ø					1									1				
"V"	22	21				1									1					
"W"	23	22			1									1						
"X"	24	23		1									1							
"Y"	25	24	1									1								
"Z"	26	25								1	Fourth Module								1	Fourth Module
"a"	27	26							1									1		
"b"	28	27						1									1			
"c"	29	28					1									1				
"d"	3Ø	29				1									1					
"e"	31	3Ø			1									1						
"f"	32	31		1									1							
"g"	33	32	1									1								

For BCD and Binary modes . . .

IR Remote (up to 76 messages can be programmed) Message File Letter	SPECTRUM Messaging Software Message Number (decimal)	CPU Module Message Number (decimal)	Operating Mode															
			BCD (Mode 2)								Binary (Mode 3)							
			10's digit				1's digit				MSB							LSB
			8	4	2	1	8	4	2	1	128	64	32	16	8	4	2	1
			I7	I6	I5	I4	I3	I2	I1	I0	I7	I6	I5	I4	I3	I2	I1	I0
"A"	1	0	No input = message "A" displayed on Message Sign								No input = message "A" displayed on Message Sign							
"B"	2	1								1								1
"C"	3	2							1								1	
"D"	4	3							1	1							1	1
"E"	5	4						1								1		
"F"	6	5						1		1						1		1
"G"	7	6						1	1							1	1	
"H"	8	7						1	1	1						1	1	1
"I"	9	8					1								1			
"J"	10	9					1			1					1			1
"K"	11	10				1									1		1	
"L"	12	11				1				1					1		1	1
"M"	13	12				1			1						1	1		
"N"	14	13				1			1	1					1	1		1
"O"	15	14				1		1							1	1	1	
"P"	16	15				1		1		1					1	1	1	1
"Q"	17	16				1		1	1					1				
"R"	18	17				1		1	1	1				1				1
"S"	19	18				1	1							1			1	
"T"	20	19				1	1			1				1			1	1
"U"	21	20			1									1		1		
"V"	22	21			1					1				1		1		1
"W"	23	22			1				1					1		1	1	
"X"	24	23			1				1	1				1		1	1	1
"Y"	25	24			1			1						1	1			
"Z"	26	25			1			1		1				1	1			1
"a"	27	26			1			1	1					1	1		1	
"b"	28	27			1			1	1	1				1	1		1	1
"c"	29	28			1		1							1	1	1		
"d"	30	29			1		1			1				1	1	1		1
"e"	31	30			1	1								1	1	1	1	
"f"	32	31			1	1				1				1	1	1	1	1
"g"	33	32			1	1			1				1					
"h"	34	33			1	1			1	1			1					1
"i"	35	34			1	1		1					1				1	
"j"	36	35			1	1		1		1			1				1	1
"k"	37	36			1	1		1	1				1			1		
"l"	38	37			1	1		1	1	1			1			1		1
"m"	39	38			1	1	1						1			1	1	
"n"	40	39			1	1	1			1			1			1	1	1
"o"	41	40		1									1		1			
"p"	42	41		1						1			1		1			1
"q"	43	42		1					1				1		1		1	

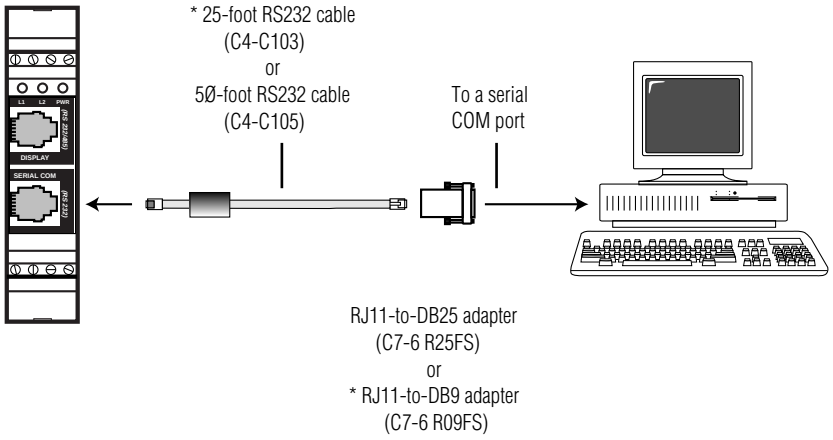
IR Remote (up to 76 messages can be programmed) Message File Letter	SPECTRUM Messaging Software Message Number (decimal)	CPU Module Message Number (decimal)	Operating Mode															
			BCD (Mode 2)								Binary (Mode 3)							
			10's digit				1's digit				MSB							LSB
			8	4	2	1	8	4	2	1	128	64	32	16	8	4	2	1
			I7	I6	I5	I4	I3	I2	I1	IØ	I7	I6	I5	I4	I3	I2	I1	IØ
"r"	44	43		1					1	1			1		1		1	1
"s"	45	44		1				1					1		1	1		
"t"	46	45		1				1		1			1		1	1		1
"u"	47	46		1				1	1				1		1	1	1	
"v"	48	47		1				1	1	1			1		1	1	1	1
"w"	49	48		1			1						1	1				
"x"	5Ø	49		1			1			1			1	1				1
"y"	51	5Ø		1		1							1	1			1	
"z"	52	51		1		1				1			1	1			1	1
"1"	53	52		1		1			1				1	1		1		
"2"	54	53		1		1			1	1			1	1		1		1
"3"	55	54		1		1		1					1	1		1	1	
"4"	56	55		1		1		1		1			1	1		1	1	1
"5"	57	56		1		1		1	1				1	1	1			
"6"	58	57		1		1		1	1	1			1	1	1			1
"7"	59	58		1		1	1						1	1	1		1	
"8"	6Ø	59		1		1	1			1			1	1	1		1	1
"9"	61	6Ø		1	1								1	1	1	1		
"+"	62	61		1	1					1			1	1	1	1		1
"-"	63	62		1	1				1				1	1	1	1	1	
"*"	64	63		1	1				1	1			1	1	1	1	1	1
"/"	65	64		1	1			1				1						
"="	66	65		1	1			1		1		1						1
"<"	67	66		1	1			1	1			1					1	
">"	68	67		1	1			1	1	1		1					1	1
"(" [1]	69	68		1	1		1					1				1		
")" [1]	7Ø	69		1	1		1			1		1				1		1
"!"	71	7Ø		1	1	1						1				1	1	
"#"	72	71		1	1	1				1		1				1	1	1
"&"	73	72		1	1	1			1			1			1			
"%"	74	73		1	1	1			1	1		1			1			1
"$"	75	74		1	1	1		1				1			1		1	
";"	76	75		1	1	1		1		1		1			1		1	1
":"	77	76		1	1	1		1	1			1			1	1		
"."	78	77		1	1	1		1	1	1		1			1	1		1
"[" [1]	79	78		1	1	1	1					1			1	1	1	
"]" [1]	8Ø	79		1	1	1	1			1		1			1	1	1	1

[1] This message cannot be programmed using an IR Remote Control.

Creating messages using SPECTRUM Messaging software

NOTE: If one or more Input Modules are connected to the CPU Module, you may want to temporarily disconnect the CPU Module from the Input Modules. Otherwise, signals coming into the Input Modules may interfere with downloading messages from the SPECTRUM Messaging software.

1. Connect a PC to the CPU Module:

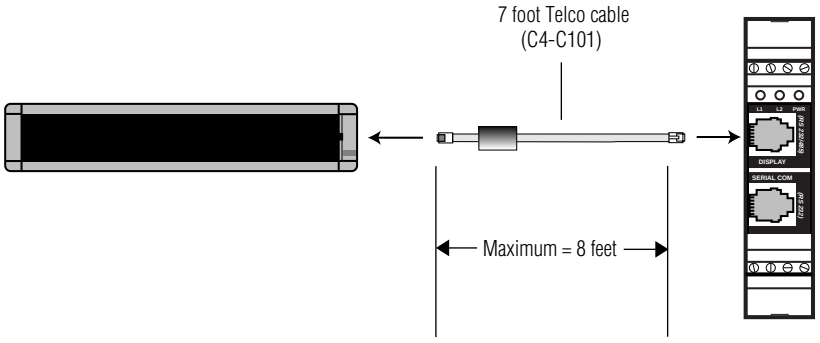


* Included with the SPECTRUM Messaging software

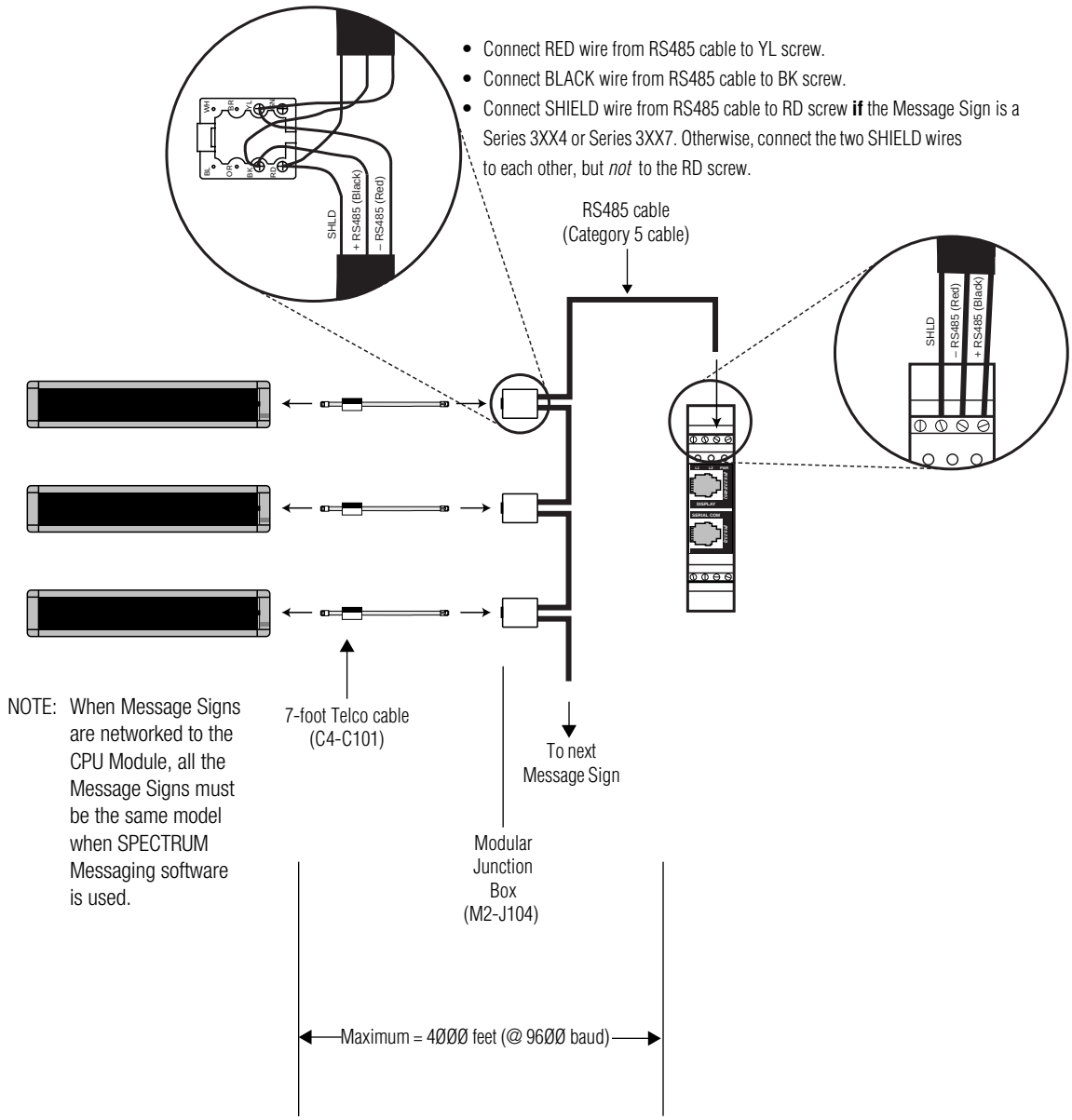
2. Create messages using the SPECTRUM Messaging software.

3. Network one or more SPECTRUM Message Sign to the CPU Module (below). Then store the messages in the Message Signs using SPECTRUM Messaging software.

Networking a single Message Sign (unshielded)



Networking one or more Message Signs (shielded)



- Connect RED wire from RS485 cable to YL screw.
- Connect BLACK wire from RS485 cable to BK screw.
- Connect SHIELD wire from RS485 cable to RD screw **if** the Message Sign is a Series 3XX4 or Series 3XX7. Otherwise, connect the two SHIELD wires to each other, but *not* to the RD screw.

NOTE: When Message Signs are networked to the CPU Module, all the Message Signs must be the same model when SPECTRUM Messaging software is used.