

Product Manual

9110

Serial Controlled
Input/Output Module

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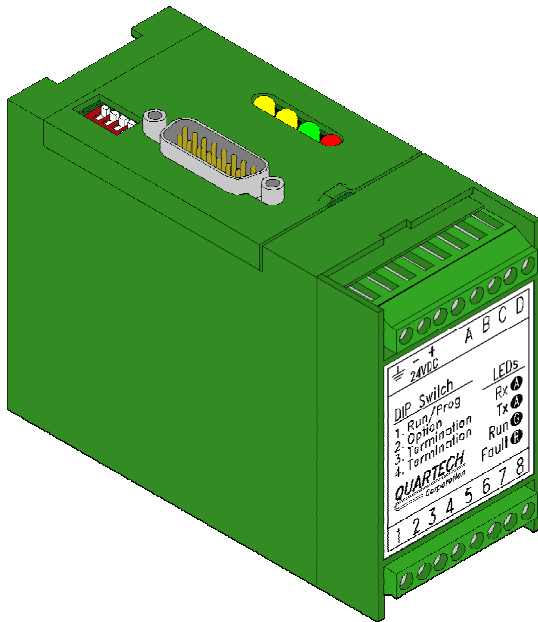
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***The latest version of ProjectMaker 9110 and this
Product Manual are available free of charge at
our web site: www.quartechcorp.com***

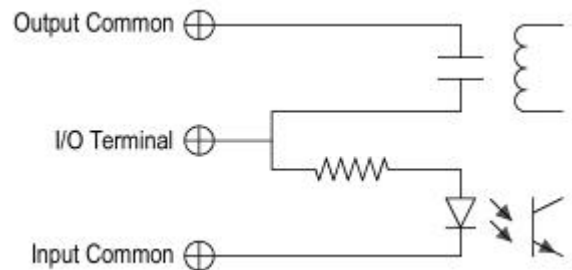


The 9110 is a discrete input/output module that interfaces to a host device via a RS-232 or RS-485 serial communication link. Eight circuits are provided and can be individually configured as an input or output using ProjectMaker 9110 Windows™ based offline configuration software. Project files are safely stored in EEPROM memory.

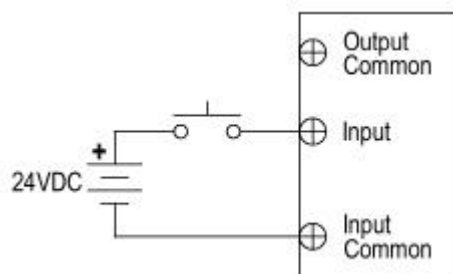
The 9110 is designed for twenty four volt operation. Inputs are optically coupled and outputs are relay type. It mounts on a standard DIN rail and measures approximately 1¾ inches wide, 3¼ inches high, and 4¼ inches deep.

The 9110 has a factory installed driver that allows it to communicate with a particular type of host device such as a Motor Drive, Programmable Controller, or Computer.

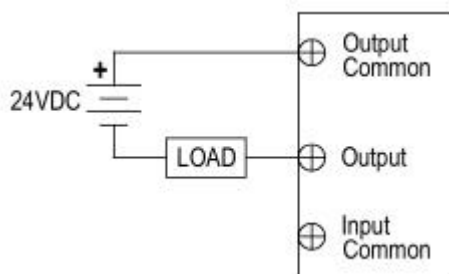
The schematic to the right shows the typical electrical configuration for each of the eight circuits. Each circuit has a separate **Circuit Terminal**. Circuits one through four share an **Input Common** and **Output Common** terminal. Circuits five through eight share an **Input Common** and **Output Common** terminal.



Typical Input Configuration



Typical Output Configuration



Section 2: Project Download

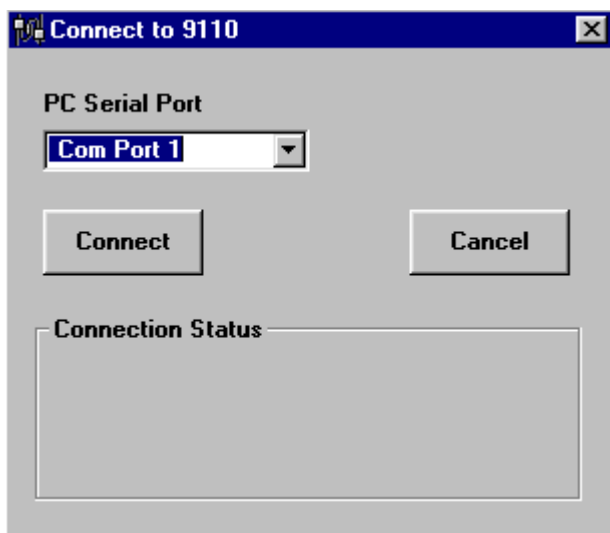
The 9110 is shipped from the factory with the project memory clear. Before connecting it to a host device, a project file must be downloaded using ProjectMaker 9110 configuration software running on your personal computer.

The 9110 is placed into the project file transfer mode (program mode) by applying power with DIP switch one set to the on position. The 9110 signifies it is in program mode by lighting the green Run LED. A Quartech 2136-10 communication cable must be connected between the 9110 and the personal computer COM port.

The Project Download option is available in ProjectMaker only when a project is open. Download may be selected from the Communication menu or by clicking on the download icon.



The following dialog box will open when the download option is selected:



If an integrity check has not recently been performed on the project you will be prompted to allow a check. You can not download a project that has not been validated.

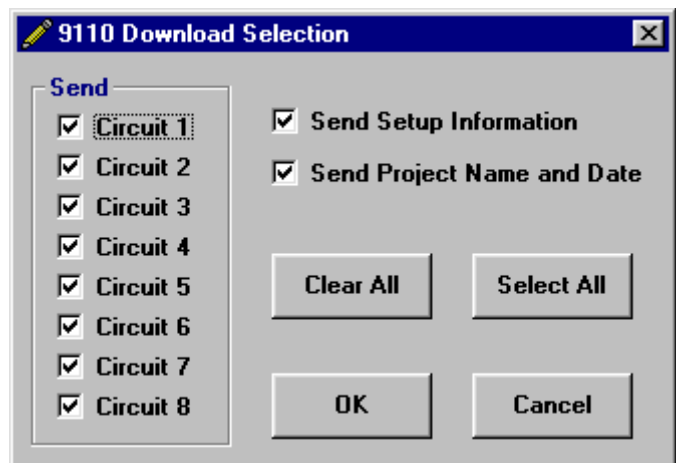
Prior to clicking the Connect button insure the correct PC COM port is displayed, the 9110 is in program mode, and the communication cable is connected between the PC and 9110.

Communication status messages and fault messages are displayed in the Connection Status frame. When a successful connection is made the 9110 driver type and firmware revision level will be appended to the title bar of the Connect dialog box.

If a successful connection is made between the personal computer and 9110, then the dialog box to the right will open. This dialog box allows you to download the entire project or only parts that have been modified.

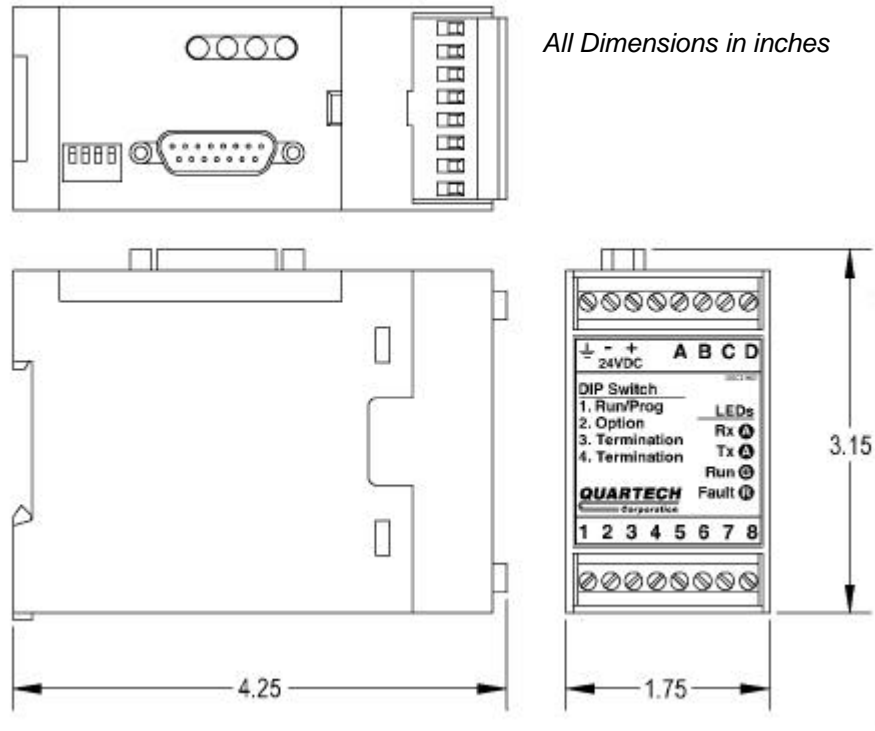
When a new project is created, the entire project must be download. Subsequent changes to circuits or setup data may then be individually downloaded.

It takes approximately one minute to download an entire project file to the 9110.



Appendix A: Electrical/Mechanical Specification

The 9110 is designed to be mounted within an enclosure that will protect it from moisture, dust, and other air born contaminants. Care must be taken to prevent metal chips or other conductive particles such as wire clippings from entering the unit. Failure to protect the unit may cause damage when power is applied and may void the warranty.



A minimum clearance of three inches should be kept between the 9110 and any other device that generates heat. To maintain failure free operation the internal enclosure temperature must not exceed 60°C (122°F).

Wiring Considerations

Care should be taken when routing DC power supply wires and the communication cable. Follow these guidelines for a trouble free installation. The DC power lines and communication cable must be kept away from AC power lines. Keep both at least one foot away from 115 VAC lines, and two feet away from higher voltage lines. This especially applies to the communication cable. If the cables must cross AC power lines, cross them at right angles (90°). Keep the cables away from sources of high energy fields such as arc welders, AC motors, motor starters, servo controllers, generators, induction heaters, and transformers.

Specifications:

Source Power:	24 VDC, ±5%, @ 200 ma
Input Circuit Resistance	Nominal five thousand ohms
Output Circuit Current	300 milliamps @ 24VDC
Temperature:	0°C to +60°C Operational, -20°C to +70°C Storage
Humidity	10% to 95%, Non-condensing, Operational or storage
Vibration/Shock:	0.5mm displacement (X,Y,Z axis), 10-55Hz, 30G shock
Weight:	8 ounces
Mounting:	DIN rail mounting (EN 50 022)

4 Position DIP Switch

- Switch 1 - Run / Program This switch is set to the on position only when a project file is to be transferred to or from the 9110. See Section 2 for details.
- Switch 2 - Option Individual Drivers may use this switch to enable a special feature.
- Switches 3 & 4- Termination Connects a 240 ohm resistor across the RS-485 receiver lines. Two switches are provided to meet both RS-422 and RS-485 specifications.

Serial Communication Port

A 15 pin male D-Type connector provides the communication interface to the host device or Personal Computer. Both RS-232 and RS-485 are provided and are software selected.

Pin #	Description
2	RS-232 Transmit Data (TXD)
3	RS-232 Receive Data (RXD)
4	RS-232 Request To Send (RTS)
5	RS-232 Clear To Send (CTS)
7	Signal Common
15	Signal +5

Pin #	Description
6	RS-485 Transmitter A (TxD _A)
14	RS-485 Transmitter B (TxD _B)
13	RS-485 Receiver A (RxD _A) **
12	RS-485 Receiver B (RxD _B) **
11	Signal Common
10	Signal Common

** When the RS-485 port is use in the two wire configuration, these connections become RxTx_A and RxTx_B.

LED Indicators

Four Light Emitting Diodes (LED) are visible through the top cover. The LEDs primary function is indicated on the product label.

- Fault LED** This red LED will light to indicate an error condition exists. Some errors are fatal an will halt operation of the 9110. Fault information is discussed in Appendix B.
- Run LED** This green LED will flash when the 9110 is in Run Mode and no fatal faults exist. In Program Mode it is lit continuous.
- Tx LED** This amber LED will light while a packet of serial data is being transmitted by the 9110.
- Rx LED** This amber LED will light while a packet of serial data is being accepted by the 9110.

Terminal Blocks

Two eight position terminal blocks are exposed at the front of the unit. The individual connection points on the bottom terminal block are numbered one through eight and are the eight Input/Output circuit terminals. Source power and earth ground connections on the top terminal block are marked on the product label. One unmarked terminal is an unconnected spare. The connections marked A, B, C, and D on the top terminal block are the circuit common connections described below.

- Terminal A** This is the input common connection for input circuits one through four.
- Terminal B** This is the input common connection for input circuits five through eight.
- Terminal C** This is the output common connection for output circuits one through four.
- Terminal D** This is the output common connection for output circuits five through eight.

Appendix B: Fault Codes

During Run Mode several faults can cause the 9110 to halt operation. When this occurs the Red Fault LED will begin to flash and the amber and green LEDs will light to indicate a fault code. The recognized fault codes are described below.

Rx	Tx	Run	Fault	Description
OFF	OFF	ON	FLASH	Firmware ROM checksum error
OFF	ON	OFF		System RAM read/write error
OFF	ON	ON		Project EEPROM checksum error
ON	OFF	OFF		Communication cable disconnected
ON	OFF	ON		Project Setup File is invalid
ON	ON	OFF		Spare
ON	ON	ON		Failsafe

Non fatal faults may also occur during Run Mode and will simply cause the Fault Led to light. The 9110 will turn the Fault LED off after approximately two seconds, however, if the fault remains then the Fault LED will immediately light again. Below is a list of typical non fatal faults.

- No response from the host device or other serial communication errors (baud, parity, etc.).
- Invalid or non-configured circuit information.
- Invalid Node address or command not allowed by host at this time.

Project Load Cable

The schematic below shows the cable required to transfer Project Files between the 9110 and a personal computer. The cable is available from Quartech in a standard ten foot length.

File Download Cable

Quartech Part Number: 2136-10

Personal Computer		9110	
9 Pin Female D-Type		15 Pin Female D-Type	
RXD	2 >)))))))))))))))))) < 2	TXD	
TXD	3 >)))))))))))))))))) < 3	RXD	
SC	5 >)))))))))))))))))) < 7	SC	
RTS	7 >)), ,	+))))) < 4	RTS
CTS	8 >)) -	.))))) < 5	CTS
DCD	1 >)),		
DTR	4 >)) 1		
DSR	6 >)) -		

9110 to Allen-Bradley Ultra 100/200 Drive

RS-232 Communication Cable

Quartech Part Number: 2161-10

ULTRA 100/200		9110	
9 Pin Male D-Type		15 Pin Female D-Type	
RXD	2 <)))))))))))))))))) < 2	TXD	
TXD	3 <)))))))))))))))))) < 3	RXD	
SC	5 <)))))))))))))))))) < 7	SC	
		+))))) < 4	RTS
		.))))) < 5	CTS

RS-485 Communication Cable

Quartech Part Number: 2162-10

ULTRA 100/200		9110	
9 Pin Male D-Type		15 Pin Female D-Type	
RXD+	1 <)))))))))))))))))) < 14	TxdB	
RXD-	7 <)))))))))))))))))) < 6	TxdA	
TXD+	4 <)))))))))))))))))) < 12	RxdB	
TXD-	8 <)))))))))))))))))) < 13	RxdA	
SC	5 <)))))))))))))))))) < 7	SC	
		+))))) < 4	RTS
		.))))) < 5	CTS

Appendix D: AB Ultra Driver Information

The ProjectMaker 9110 configuration form for the Allen-Bradley Ultra 100/200 driver is shown below.

Circuit	Type	Function	Node
Circuit 1	Input	Host Drive Enable/Disable	Node 0
Circuit 2	Input	Start Index	Node 0
Circuit 3	Disabled	No Reference Assigned	Node 0
Circuit 4	Output	Drive Status: Disabling Fault	Node 0
Circuit 5	Output	Drive Status: In Position	Node 0
Circuit 6	Output	Drive Status: In Motion	Node 0
Circuit 7	Output	Drive Status: In Dwell	Node 0
Circuit 8	Output	Drive Status: Sequence Complete	Node 0

Interface Type: RS-232 RS-485

Baud Rate: 9600 19200

Power-on Update: YES NO

Retry Count: 3

The 9110ABU uses the ULTRA 100 default setting: 8 Data bits, No Parity, 1 Stop bit. The baud rate is selectable between 9600bps and 19,200bps. The 9110ABU can be connected to a single Drive or multiple drives. Multiple 9110ABU units can be connected to a single drive using the Quartech 8517 Multiplexer.

The following addresses are supported:

Analog Input Acceleration Limits Enable	Input or Output
Analog Output Override Enable	Input or Output
Auto-start Indexing Flag	Input or Output
Change Direction Flag	Input or Output
Define Home Position	Input
Digital Input: Reset Faults	Output
Digital Input: Enable	Output
Digital Input: Input 1	Output
Digital Input: Input 2	Output
Digital Input: Input 3	Output
Digital Input: Input 4	Output
Digital Output Override Enable	Input or Output
Digital Outputs: Ready	Output
Digital Outputs: Brake	Output
Digital Outputs: Output 1	Output
Digital Outputs: Output 2	Output

Digital Outputs: Output 3	Output
Digital Outputs: Output 4	Output
Drive Mode	Input or Output
Drive Status: In Position	Output
Drive Status: Within Position Window	Output
Drive Status: Zero Speed	Output
Drive Status: Within Speed Window	Output
Drive Status: Positive I-Limit	Output
Drive Status: Negative I-Limit	Output
Drive Status: At Speed	Output
Drive Status: Drive Enabled	Output
Drive Status: DC Bus Charged	Output
Drive Status: Disabling Fault	Output
Drive Status: Brake Active	Output
Drive Status: Drive Ready	Output
Drive Status: Torque Mode	Output
Drive Status: Integrator Inhibit	Output
Drive Status: Follower Enable	Output
Drive Status: Forward Clamp	Output
Drive Status: Reverse Clamp	Output
Drive Status: Analog Override	Output
Drive Status: Preset Select Line A	Output
Drive Status: Preset Select Line B	Output
Drive Status: Preset Select Line C	Output
Drive Status: Reset Faults	Output
Drive Status: Enable Active	Output
Drive Status: At Home	Output
Drive Status: Sequence Complete	Output
Drive Status: In Motion	Output
Drive Status: In Dwell	Output
Drive Status: Registration Detected	Output
Fault Status: I/O +24VDC Overcurrent	Output
Fault Status: Encoder +5VDC Overcurrent	Output
Fault Status: Encoder +7VDC Overcurrent	Output
Fault Status: Motor Overtemperature	Output
Fault Status: IPM Fault	Output
Fault Status: Channel IM Line Breake	Output
Fault Status: Channel BM Line Break	Output
Fault Status: Channel AM Line Break	Output
Fault Status: Bus Undervoltage	Output
Fault Status: Bus Overvoltage	Output
Fault Status: Illegal Hall State	Output
Fault Status: Sub processor unused interrupt	Output
Fault Status: Main processor unused interrupt	Output
Fault Status: Excessive Average Current	Output
Fault Status: Motor Overspeed	Output
Fault Status: Excessive Following Error	Output

Fault Status: Motor Encoder State Error	Output
Fault Status: Master Encoder State Error	Output
Fault Status: Motor Thermal Protection	Output
Fault Status: IPM Thermal Protection	Output
Fault Status: Velocity Error	Output
Fault Status: Commutation Angle Error	Output
Fault Status: Axis Not Homed	Output
Fault Status: Enabled with no Motor Selected	Output
Fault Status: Motor Selection not in Table	Output
Fault Status: CPU Communication Error	Output
Home Sensor Back-off Flag	Input or Output
Host Drive Enable/Disable	Input or Output
Host Index Control Enable Flag	Input or Output
Low Pass Filter Enable	Input or Output
Master Rotation Direction	Input or Output
Motor Forward Direction Flag	Input or Output
Mode Status: Auto Tune Complete	Output
Mode Status: Encoder Alignment Complete	Output
Mode Status: Motor Index Detected	Output
Mode Status: Master Index Detected	Output
Mode Status: Motor Encoder Resolution Determined	Output
Mode Status: Master Encoder Resolution Determined	Output
Mode Status: Auto Tune Failed	Output
Override Drive Mode	Input or Output
Preset Acceleration Limits Enable	Input or Output
PWM Frequency Switching Disable	Input or Output
Remove Alignment Offset	Input
Reset Drive	Input
Reset Faults	Input
Reset Peaks	Input
Reset Personality EEPROM	Input
Setpoint Control Enable Flag	Input or Output
Slew Enable	Input or Output
Start Homing	Input
Start Index	Input
Thermal Time Constant Enable	Input or Output
Thermostat Flag	Input or Output

Refer to the Allen-Bradley Host Command Reference File and ULTRA MASTER help file for detailed information regarding the various commands. An icon in ProjectMaker 9110 will activate the Host Reference help file if it resides on your computer. ProjectMaker 9110 will search the directory path **C:\Ultramst\Host_Ref.hlp**. If the file is located in a different directory you can point ProjectMaker to it and it will be retained for future access.

Appendix E: Definable ASCII Driver Information

The ProjectMaker 9110 configuration form for the definable ASCII driver is shown below.

Circuit	Circuit Type	Packet Definition
Circuit 1	Input, Send on Make	IN 1 / M A K E
Circuit 2	Input, Send on Break	IN 2 \ B R E A K
Circuit 3	Input, Send Make/Break	I N P U T = ?
Circuit 4	Output, On/Off Control	O U T P U T 4 = ?
Circuit 5	Output, One Shot Close	O U T P U T 5
Circuit 6	Output, One Shot Open	O U T P U T 6
Circuit 7	Disabled	
Circuit 8	Disabled	

Protocol Parameters

@	?	CR	None
Start Character	Place Holder	End Character	Acknowledge Method

Networking - Unit Enable Packet

#	01	CR
Prefix Characters	Node Address	Suffix Characters

Interface Type: RS-232 RS-485

Baud Rate: 9600

Parity: None

Operating Mode: Active Slave

Project Name: SAMPLE **Project Date**: 11/15/2000

This form allows the user to specify the communication protocol that will occur between the 9110 and host device. The information transmitted to between the devices is called a data packet. All data packets have a common Start Character and End Character which is specified in the configuration form. A networking packet has it own start and end characters that may or may not be the same characters use for the data packet.

Each circuit can have up to eleven data characters (Packet Definition) associated with it. If the Circuit Type is an input then the Packet Definition string is transmitted when the switch changes to a qualifying state. If the Circuit Type is an output then the Packet Definition string must match a received data packet to cause an output state change. The actual input or output type determines the qualifying condition that will cause packet transmission or output state change.

Input, Send on Make: The Packet Definition string will be sent only when the associated input becomes energized.

Input, Send on Break: The Packet Definition string will be sent only when the associated input becomes de-energized.

Input, Send Make/Break The Packet Definition string will be sent whenever the input state changes. The Place Holder Character has special significance with this input type. If the Place Holder character is present within the Packet Definition string then upon transmission it will be replaced by an ASCII 1 if the input is energized or an ASCII 0 if the input is de-energized.

Note: If networking is enabled and the unit is not selected then input state changes will be ignored. Quatech recommends that the Active operating mode not be used with networking unless none of the circuits are configured as inputs.

Output, One Shot Close When a received data packet exactly matches the Packet Definition string the associated output will energize for approximately one half second.

Output, One Shot Open When a received data packet exactly matches the Packet Definition string the associated output will de-energize for approximately one half second. When the 9110 is first powered the memory will be searched for this output type and if found the associated output will be immediately energized.

Output, On/Off Control The host device can energize or de-energize this output type at will. The Place Holder Character has special significance with this output type. To control the output the host device must substitute an ASCII 1 or 0 for the Place Holder character in order to energize or de-energize the output circuit.

Acknowledge Method:

The Acknowledge Method determines if a response is sent to the host device after an output control command is accepted. When **Send ACK** is selected, the 9110 will transmit an ACK character (06hex) to the host device after the output control command is verified and executed. When **Echo All** is selected, the 9110 will transmit an exact copy of the received command to the host device after the output control command is verified and executed. The 9110 never expects to receive an acknowledge from the host device and will simply ignore one if sent.

The Acknowledge Method also affects the Networking enable command. The 9110 will send an appropriate acknowledge response but never on the first reception of the enable command. For example: if the 9110 has not been enabled by the host and it receives a network enable packet with the correct Node Address then it will become enabled. No acknowledge response will be sent back to the host device. If the 9110 is currently enabled and it receives a network enable packet with the correct Node Address then it will remain enabled. An appropriate acknowledge response will be sent back to the host device unless None is selected.

Networking - Unit Enable Packet:

Networking allows multiple 9110ASC units to be wired together in a single master, multiple slave configuration using the RS-485 hardware interface. In this configuration the 9110ASC will power up with its transmit circuit in the high impedance state. The host device is responsible enabling a particular 9110ASC on the network by sending a network enable packet containing a legitimate node address.

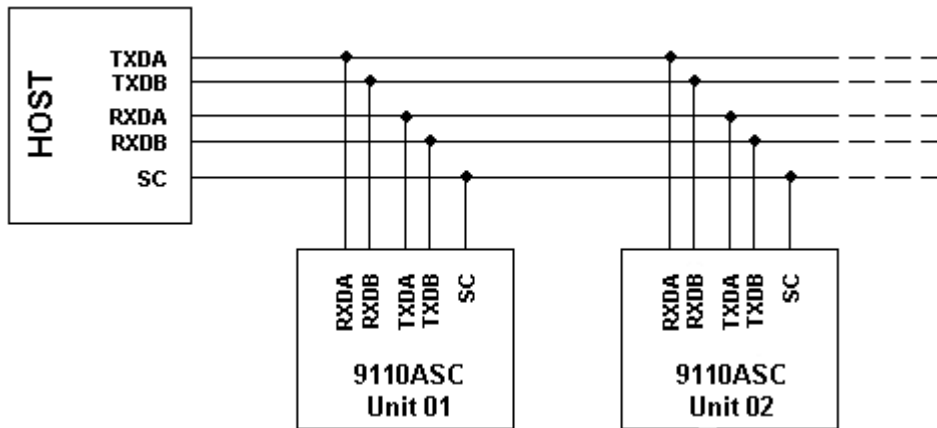
The network enable packet has three assignable components.

Prefix Character: The prefix may be one or two characters. Each may be any character from 01h to FFh but must be unique within the overall protocol with one exception. The first or only character may be the same as the Start Character.

Node Address: The node address may be any value from 00 to 99. When set to 00 networking is disabled.

Suffix Character: The suffix may be one or two characters. Each may be any character from 01h to FFh but must be unique within the overall protocol with one exception. The second or only character may be the same as the End Character.

When networking is selected and the 9110 is not currently enabled (its transmitter is in the high impedance state) the green LED will flash at a one second rate. If an input changes state it will be ignored and no transmission will occur. When the 9110 becomes enabled the green LED will flash at a one half second rate. Outputs may then be controlled and inputs will function normal. If the 9110 receives a node packet with a different node address it will become disabled.



The schematic above shows typical wiring for a single master multiple slave network. This RS-485 or RS-422 network must be wired in a point-to-point fashion. A main trunk line with drop lines is not acceptable. Depending on the overall length of the network, termination resistors may need to be applied to the RXD terminals at the far ends of the network. The 9110 has internal termination resistors that may be connected by setting a DIP switch. If termination is required and the host device uses RS-422 hardware then DIP switch three on the 9110 is set to the on position. If the host device uses RS-485 the both DIP switch three and four are set to the on position.

Operating Modes:

Two modes of operation are available in the 9110ASC. The desired mode is selected using the ProjectMaker 9110 configuration software. The mode description that follow assume the configuration shown in the ASCII Protocol Configuration form on page 10 is loaded into the 9110.

ACTIVE MODE:

This mode is the most flexible and relies on the packet definitions and protocol parameters to completely define the communication protocol.

If the host device transmits: @ **OUTPUT 4 = 1 CR** output four would energize.

If input 1 is energized the 9110 would transmit: @ **IN 1 MAKE CR**

SLAVE MODE:

This mode has a single read command and a single write command. The Start and End Characters are user defined, while the Place Holder character and Packet Definition are ignored.

The read command format is: [Start Character] [R] [End Character]. In this case @ R CR

The read response format is: [Start Character] [XXXXXXXX] [End Character].

X is either an ASCII 0 or 1 depending on the input state.

The write command format is: [Start Character] [YYYYYYYY] [End Character].

Y is either an ASCII 0 or 1. A 1 will energize an output.

Only circuits that are set for **Output, On/Off Control** are affected by a write command.

Appendix F: Standard ASCII Code Table

Decimal	Hex	Character	Decimal	Hex	Character	Decimal	Hex	Character
0	00	ctrl @ NUL	43	2B	+	86	56	V
1	01	ctrl A SOH	44	2C	,	87	57	W
2	02	ctrl B STX	45	2D	-	88	58	X
3	03	ctrl C ETX	46	2E	.	89	59	Y
4	04	ctrl D EOT	47	2F	/	90	5A	Z
5	05	ctrl E ENQ	48	30	0	91	5B	[
6	06	ctrl F ACK	49	31	1	92	5C	\
7	07	ctrl G BEL	50	32	2	93	5D]
8	08	ctrl H BS	51	33	3	94	5E	^
9	09	ctrl I HT	52	34	4	95	5F	_
10	0A	ctrl J LF	53	35	5	96	60	'
11	0B	ctrl K VT	54	36	6	97	61	a
12	0C	ctrl L FF	55	37	7	98	62	b
13	0D	ctrl M CR	56	38	8	99	63	c
14	0E	ctrl N SO	57	39	9	100	64	d
15	0F	ctrl O SI	58	3A	:	101	65	e
16	10	ctrl P DLE	59	3B	;	102	66	f
17	11	ctrl Q DC1	60	3C	<	103	67	g
18	12	ctrl R DC2	61	3D	0	104	68	h
19	13	ctrl S DC3	62	3E	>	105	69	i
20	14	ctrl T DC4	63	3F	?	106	6A	j
21	15	ctrl U NAK	64	40	@	107	6B	k
22	16	ctrl V SYN	65	41	A	108	6C	l
23	17	ctrl W ETB	66	42	B	109	6D	m
24	18	ctrl X CAN	67	43	C	110	6E	n
25	19	ctrl Y EM	68	44	D	111	6F	o
26	1A	ctrl Z SUB	69	45	E	112	70	p
27	1B	ctrl [ESC	70	46	F	113	71	q
28	1C	ctrl \ FS	71	47	G	114	72	r
29	1D	ctrl] GS	72	48	H	115	73	s
30	1E	ctrl ^ RS	73	49	I	116	74	t
31	1F	ctrl _ US	74	4A	J	117	75	u
32	20	SP (space)	75	4B	K	118	76	v
33	21	!	76	4C	L	119	77	w
34	22	"	77	4D	M	120	78	x
35	23	#	78	4E	N	121	79	y
36	24	\$	79	4F	O	122	7A	z
37	25	%	80	50	P	123	7B	{
38	26	&	81	51	Q	124	7C	|
39	27	`	82	52	R	125	7D	}
40	28	(	83	53	S	126	7E	→
41	29	)	84	54	T	127	7F	DEL
42	2A	*	85	55	U			