VELOCITY
Velocity Software Systems Ltd.

Sprint 2000
Data Collection Terminal
Technical Reference

Document Part Number 60-200020 Rev 0.6

December 1998

Sprint 2000 Data Collection Terminal
Technical Reference

Revision History

Rev. Number	Date	Notes
0.1	3/98	Preliminary
0.2	3/98	Update
0.3	4/98	Add Belden Specifications
0.4	7/98	Add Transport Byte
0.5	10/98	Converted figures to WMF
0.6	12/98	

Warranty

Limited Warranty

Velocity Software Systems Ltd. warrants that this product is free from defective materials and workmanship for a period of one year from the date of shipment.

Velocity Software Systems Ltd. further warrants that if the product fails to operate within the one year warranty period and the failure is due to improper workmanship or defective materials, Velocity Software Systems Ltd. will, at its option, repair or replace the product.

Velocity Software Systems Ltd. or its authorised agent must perform all warranty repairs.

Warranty Exclusions

This warranty shall not apply to damage or defects resulting from accidents, fire, flood and/or other acts of God; misuse, incorrect line voltage, improper installation, improper or unauthorised repairs or damage that occurs in shipping. Exterior and interior finish, lamps and glass are not covered by this warranty. This warranty will automatically be void for any unit found with a missing or altered serial number.

Warranty Limitations

The warranty set forth above is exclusive and no other warranty, whether written or oral, expressed or implied, applies. Velocity Software Systems Ltd. specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

Any claim under the warranty is limited to the purchase price of the unit. Velocity disclaims any consequential or other damages that may result from a brooch of the warranty.

Service during the Warranty Period

If the hardware should fail during the warranty period, contact Velocity Software Systems Ltd. or its authorised agent.

When sending equipment to Velocity Software Systems Ltd ensure that the equipment is properly packaged so as to prevent further damage that may occur during transit. Also, complete and enclose a copy of the Service Information Form and enclose a copy of your proof of purchase. Insuring the equipment for shipment is recommended and the shipping costs must be pre-paid.

Shipping damage as a result of inadequate packaging is the customers' responsibility.

Section 1. Features and Specifications

Overview

The Sprint 2000 Data Collection Terminal provides high-level command control for barcode wands and scanners, keypad, 16 character by 2 line LCD modules, LEDs and other RS-232 compliant peripheral devices. In short, the 2000 series device provides a total data entry solution for the Data Collection industry.

The Terminal features a full 16 bit microprocessor, switched power regulator and overload protection, EEPROM for long term maintenance statistics, multidrop RS-485 communication port a set of digital inputs and an RS-232 port. Optionally the device supports up to 512kB of non-volatile memory for offline transaction storage, a real time clock to time stamp transactions, a buzzer for audible feedback of key entries and barcode reads. A backlit display can be ordered in place of the standard display.

The Sprint 2000 can function in an offline mode; wherein the transactions entered at the terminal are held until the host initiates a download request. The transactions are held in non-volatile memory through the use of a file system. The device can hold upwards of 45 transactions per kilobyte of memory. The non-volatile memory may be ordered in various sizes ranging from 32kB through 512kB. In this offline mode, the display is driven by an on board menu system. The menu system guides the user through the stages of a transaction. Menu systems can be designed for specific client's needs.

The firmware offers a robust master slave communication protocol and a fully featured command set. For those units with a real time clock, the firmware will automatically adjust for daylight savings times if desired.

The Sprint 2000 is designed to work with most barcode wands and scanners that provide a digit TTL output for code 39 symbology. Decryption of alternate symbologies is available as are other input technologies such as magnetic stripe or Weigand.

General Operation

The Sprint 2000 Data Collection terminal communicates with a host computer or controller via a standard EIA RS-485 multi-drop bus in a half-duplex master slave relationship. The physical layer of the bus comprises standard two wire twisted pair cable (Belden 1227A1, 1243A2, 1588A or 1590A) and is extendible up to 1000 meters (3000 ft.) for a baud rate of 19200 bps. Please consult the EIA RS-485 specification for further details on line length, speed and loading characteristics. The terminal module is configured to communicate at 19200 baud, 8 bit, 1 stop and no parity. Other data layer configurations can be specified at time of order to suit specific needs.

Each terminal reader is addressable through the network bus at its own unique address. The address is set through a DIP switch on the reader's printed circuit board. It is important that each reader on a single bus be assigned its own unique address. If two of the readers have the same address then the bus will not work properly for those units. If by oversight two or more of the units have the same address, you must reset their addresses so that they are different from each other and different from any other unit on the bus.

Sprint 2000 Data Collection Terminal
Technical Reference

The default scheme for communicating with the terminal comprises of the controller or host computer sending a poll to the terminal unit it wishes to interrogate. If the terminal unit has data to return to the host it will respond with the data otherwise it will respond with the poll response. The terminals will not proactively present data to the host. The data is presented only if the host has polled the Terminal. To ensure that each of the terminals on the bus have the opportunity to present data to the host all of the units in turn must be polled. The host should continuously poll all of the units to ensure that data is presented promptly. The frequency of the polling is determined by the application that you are developing and, at the high end, by the data rate being used and the time lags inherent in the system. Generally the host must wait at least one character time from the receipt of the end of the terminal's response before emitting the next poll. This time lag gives the terminals time to disable their transmitter and for the bus to normalise electrically. Note that in most RS-485 communication schemes it is necessary to control the transceiver's state through the use of the RTS or DTR control lines. Some PC RS-485 port manufacturers provide a device that automatically senses the data flow on the bus and switches the host's transmitter state automatically.

Communication Protocols

Poll Structure

In this variant of the bus structure, the host must provide the polling sequences for the each of the devices on the network. Note that in this scheme the Host Controller is deemed to be at address 0x00. All other devices can occupy any address between 0x01 and 0xFF. Due to restrictions of the RS-485 electrical layer only 32 devices per network can be serviced.

A Poll and the response adhere to the following format:

Byte	1	2	3	4	5
Content	<DLE>	<STX>	PID address	<DLE>	<ETX>

where:

<DLE> is hexadecimal 10 <0x10>

<STX> is hexadecimal 2 <0x02>

PID Address: The peripheral Terminal device address. When sending a Poll, this field indicates the poll's destination address. Conversely, when reading this message, this field contains the poll responses source address.

<ETX> is hexadecimal 3 <0x03>

Byte Stuffing: Byte 3 must be checked for instances of the <DLE> character. When a <DLE> character is found, it must be duplicated. For example, if the poll in hexadecimal,

<0x10><0x02><0x10><0x10><0x03>

were to be queued, it would first have to be converted to:

<0x10><0x02><0x10><0x10><0x10<0x03>

before the receiver could interpret the message correctly. Note that the <DLE> found in the address field ise duplicated so that framing is preserved.

Note that the device will begin its response to a poll within 1 to 3 character times of the receipt of the end of a valid poll.

Message Structure

All communication with the will use framed packets. The packets will adhere to the following format:

Byte	1	2	3	4	5 to (n-2)	n-1	n
Content	<DLE>	<STX>	PID address	Transport	Binary Data	<DLE>	<ETX>

where

<DLE> is hexadecimal 10 <0x10>

<STX> is hexadecimal 2 <0x02>

PID address: The peripheral interface device address. When sending a message to the poller this field indicates the message's destination address. Conversely, when reading this message from the host poller this field contains the message's source address.

Transport Byte: The Transport byte can be use to determine packet delivery. A value of 0x07 requires no acknowledgement of the packet.

Binary Data: The message to be sent to or received from a peripheral device. The data field varies in length from 0 to 126 raw bytes.

<ETX> is hexadecimal 3 <0x03>

Byte Stuffing: Bytes 3 to (n-2) must be checked for instances of the <DLE> character. When a <DLE> character is found it must be duplicated. For example, if the message in hexadecimal,

<0x10><0x02><0x10><0x07><0x10><0x02><0x10><0x03>

were to be sent, it would first have to be converted to

<0x10><0x02><0x10><0x10><0x07><0x10><0x10><0x02><0x10><0x03>

before the receiver could interpret the message correctly. Note that the <DLE> found in the address field and the embedded <DLE> in the message field are duplicated so that framing is preserved.

Data Structure

The binary data field of the message packet is structured according to

Byte	1 and 2	3 to n
Content	Message Identifier	Message Data

Identifier Structure

The application layer protocol, introduces the identifier field as part of the application level message. This field is two bytes wide and is situated at the head of the message packet. It identifies the message to the receiver. In general each message has its own unique identifier. The identifier is structured according to:

Bit	15-14	14-0
Content	Nack	Identifier

where:

Nack: A two bit structure detailing the nature of the application level response acknowledgement.

Bits	Meaning
00	acknowledged
10	Request cannot be performed
11	Bad message
01	Not used

Note that in the event of a Bad message (i.e. a message identifier that the terminal does not recognize as a legitimate request) the identifier component of the message should be incremented by one and returned to the host controller with the two high bits set.

Identifier: Is any of the message identifiers to be discussed in this document.

Message Identifiers

The following discussion concerns only those fourteen bits that comprise the actual message identifier. All identifier numbers are shown in hexadecimal notation.

General Messages

Host			TERMINAL	
Description	Id	message	response Id	message
Get Config.	106		107	8 byte Serial No.

				word Version byte LED state byte Error code
Get Up Time	10E		10F	4 bytes
Reset NVRAM	110		111	
Get NVRAM	112		113	T.B.D.
Reset	118		119	
Async. Reset			121	byte 0 normal 1 watchdog

Set Factory Options	130	20 bytes	131	
Get Factory Options	132		133	20 bytes
Async. Error Message			141	8 byte Serial No. word Version byte LED state 01 Green 02 Red 03 Both byte Error code
Set LED state	150	1 byte 00 off 01 Green on 02 Red on 03 Green and Red on	151	
Query LED state	152		153	1 byte 00 off 01 Green on 02 Red on 03 Green and Red on

Data Terminal Specific Messages

Host			TERMINAL	
Description	Id	message	response Id	message
Set Audible Tone State	610	dword period (number of 20 msec/ intervals) byte % duty cycle dword duration (number of periods)	611	dword period (number of 20 msec/ intervals) byte % duty cycle dword duration (number of periods)
Get Audible Tome State	612		613	dword period (number of 20 msec/ intervals) byte % duty cycle dword duration (number of periods)
Set Key tone	614	dword period (number of 20 msec/ intervals) byte % duty cycle dword duration (number of	615	dword period (number of 20 msec/ intervals) byte % duty cycle dword duration (number of

		periods)		periods)

Get Key tone	616		617	dword period (number of 20 msec/ intervals) byte % duty cycle dword duration (number of periods)
Set good scan tone	618	dword period (number of 20 msec/ intervals) byte % duty cycle dword duration (number of periods)	619	dword period (number of 20 msec/ intervals) byte % duty cycle dword duration (number of periods)
Get Good Scan tone	61A		61B	dword period (number of 20 msec/ intervals) byte % duty cycle dword duration (number of periods)
Set Bad Scan tone	61C	dword period (number of 20 msec/ intervals) byte % duty cycle dword duration (number of periods)	61D	dword period (number of 20 msec/ intervals) byte % duty cycle dword duration (number of periods)
Get Bad Scan tone	61E		61F	dword period (number of 20 msec/ intervals) byte % duty cycle dword duration (number of periods)
Set Keypad Enable/Disable	622	1 bytes 0/1 disable/enable	623	1 bytes 0/1 disable/enable
Get Keypad State	624		625	1 bytes 0/1 disable/enable
Key press			627	1 byte sent asynchronously when keypress detected and keypad enabled
LCD	628	Message Variable length The LCD response to embedded CR and LF, i.e 0x61 0x0A 0x41 will display two a's on two lines. and 0x61 0x0D 0x41 will display A on the first lines.	629	
Scan			631	multiple bytes sent asynchronously when scan in decoded

Set Key Echo	640	16 bytes 0 no echo 1 echo char from map 2 echo '*'	641	
Get Key Echo	642		643	16 bytes 0 no echo 1 echo char from map 2 echo '*'

Set Key Map	646	16 bytes Hex Value of character to be echoed Note that most control characters are not supported by the display	647	
Get Key Map	648		649	16 bytes Hex Value of character to be echoed Note that most control characters are not supported by the display
Set Relay State	650	dword period (number of 20 msec/ intervals) byte % duty cycle dword duration (number of periods)	651	dword period (number of 20 msec/ intervals) byte % duty cycle dword duration (number of periods)
Get Relay State	652		653	dword period (number of 20 msec/ intervals) byte % duty cycle dword duration (number of periods)

Note, if the value of the duration in set audible tone command is set to zero the buzzer will shut off. If a duration is specified with a negative value the buzzer will run continuously without end time. The duty cycle is a hexadecimal number between 0 and 100 inclusive. Get Audible tone returns the current state of the buzzer parameters, as they are decrementing.

File System Messages

Host			TERMINAL	
Description	Id	message	response Id	message
Add Record	800	byte file number word record ID (NULL) word Next ID (NULL) bytes data (< 120)	801	byte file number word record ID word Next ID
Delete Record	802	byte file number word record ID	803	
Update Record	804	byte file number word record ID word next ID (NULL) bytes data (< 120)	805	byte file number word record ID word next ID
Get Record	806	byte file number word record ID word next ID	807	byte file number word record ID word next ID bytes data (< 120)
Reset	808		809	
Avaiable bytes remaining in system	810		811	dword number of bytes avaiable
Delete file	812	byte file number	813	

Clock Messages

| Host			Terminal	
Description	Id	message	response Id	message
Set Date/Time	660	byte seconds (BCD) 0≤x≤59 byte minutes (BCD) 0≤x≤59 byte hours (BCD) 0≤x≤24 byte day of week (BCD) 0≤x≤6 byte day of month (BCD) 0≤x≤31 byte year (BCD) 0≤x≤99 byte daylight savings time bit 1 auto-switching enabled bit 0 savings time ineffect	661	byte seconds (BCD) 0≤x≤59 byte minutes (BCD) 0≤x≤59 byte hours (BCD) 0≤x≤24 byte day of week (BCD) 0≤x≤6 byte day of month (BCD) 0≤x≤31 byte year (BCD) 0≤x≤99 byte daylight savings time bit 1 auto-switching enabled bit 0 savings time ineffect
Get Date/Time	662	word record ID	663	byte seconds (BCD) 0≤x≤59 byte minutes (BCD) 0≤x≤59 byte hours (BCD) 0≤x≤24 byte day of week (BCD) 0≤x≤6 byte day of month (BCD) 0≤x≤31 byte year (BCD) 0≤x≤99 byte daylight savings time bit 1 auto-switching enabled bit 0 savings time ineffect
Set Clock NVRAM Data	664	T.B.D	665	
Get Clock NVRAM Data	666		667	T.B.D
Set Clock +1 Hour	668			
Set Clock –1 Hour	66A			

Physical Specifications

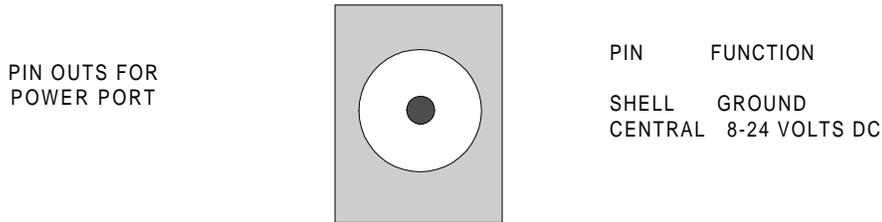|	
Display	2 line X 16 characters LCD display
Indicators	Red LED and Green LED
Audible Tone	Optional
Real Time Clock with automatic daylight saving time adjustment	Optional
Non-volatile memory	Optional up to 512kB
Data Inputs	Bar Code wand or Scanner and RS-232 port
Integrated Media Reader	Optional
Keypad	4 X 4 tactile membrane keypad (programmable)
Network Interface	RS-485 19200 baud 8 bit 1 stop no parity
Power	8 - 24 Volts DC 120 mA normal load w/o scanner 300 mA typical with scanner
Environment	Operating 0° to 45° C Humidity 0 to 95% RH non-condensing
Enclosure	High Impact Plastic Enclosure 6.1" wide X 6.25" long X 1.75" high Weight 1.5 kg (2.75 lbs)

Section 2: Installation

Connectors

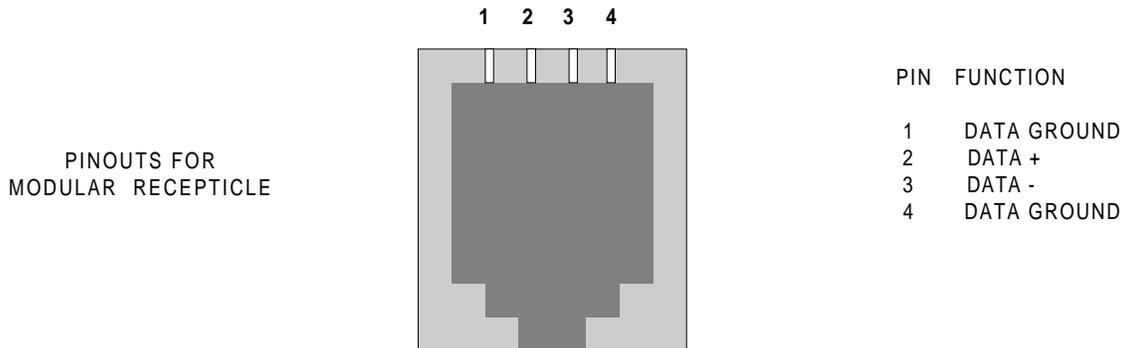At the base of the Terminal unit the following Power, LAN and peripheral connectors can be found

Power   LAN Ports   Wand/Scanner Port   RS-232 Port
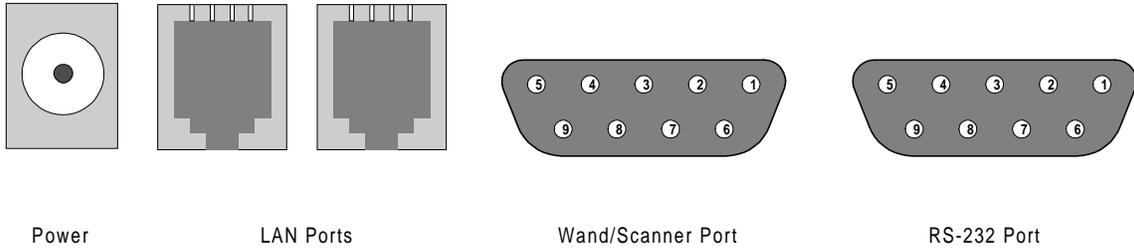
Connector PinOuts

The Input power port is configured as

PIN OUTS FOR
POWER PORT


```
PIN         FUNCTION

SHELL    GROUND
CENTRAL   8-24 VOLTS DC
```

The LAN connectors are described as

PINOUTS FOR
MODULAR RECEPTICLE


```
PIN   FUNCTION

1      DATA GROUND
2      DATA +
3      DATA -
4      DATA GROUND
```
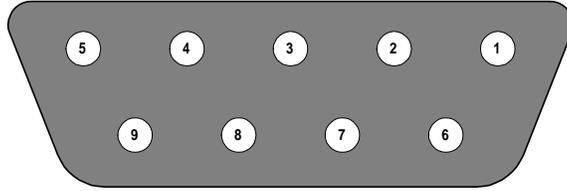
The two ports are connected in parallel to allow units to be daisy chained.

The Wand/Scanner input port is configured as

PINOUTS FOR
DB9 FEMALE
CONNECTOR

PIN   FUNCTION

2   DATA-
7   GROUND
9   VCC (5 vOLTS)

DIP Switch Settings

In using the dip switch to set the address, it is important to note that address zero is invalid and reserved for the host controller.

| Switch #	Function	Factory Default	Notes
1	Address Low Bit	Off = 0	
2	Address	Off = 0	
3	Address	Off = 0	
4	Address	Off = 0	
5	Address	Off = 0	
6	Address	Off = 0	
7	Address High bit	Off = 0	
8	N/A		Reserved

The dipswitch can be found in the Terminal enclosure on the PCB.

LAN Installation notes

The general layout for multiple nodes can be configured in one of the following two ways,
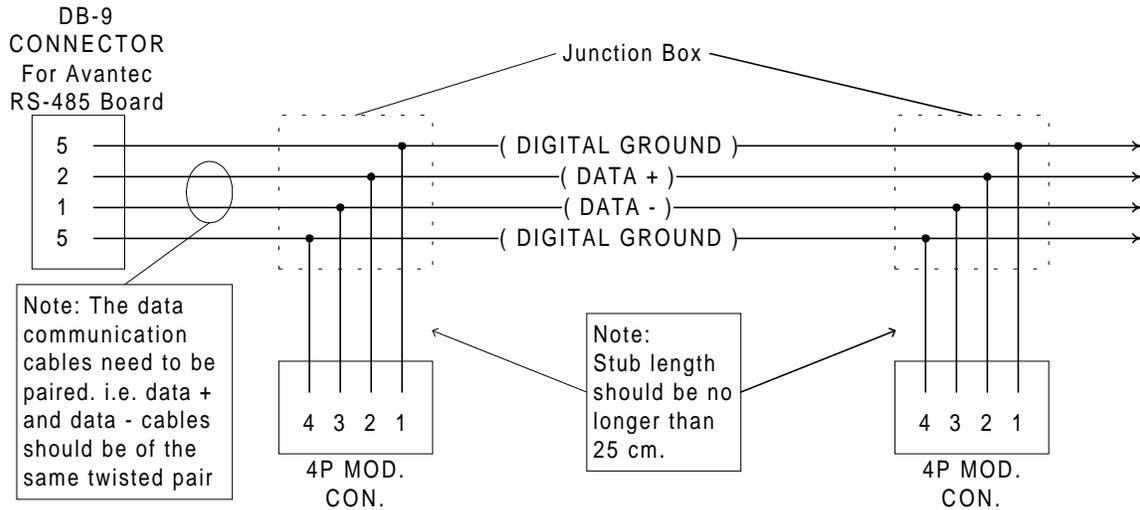

Up to 31 Data Units

or

Up to 31 Data Units
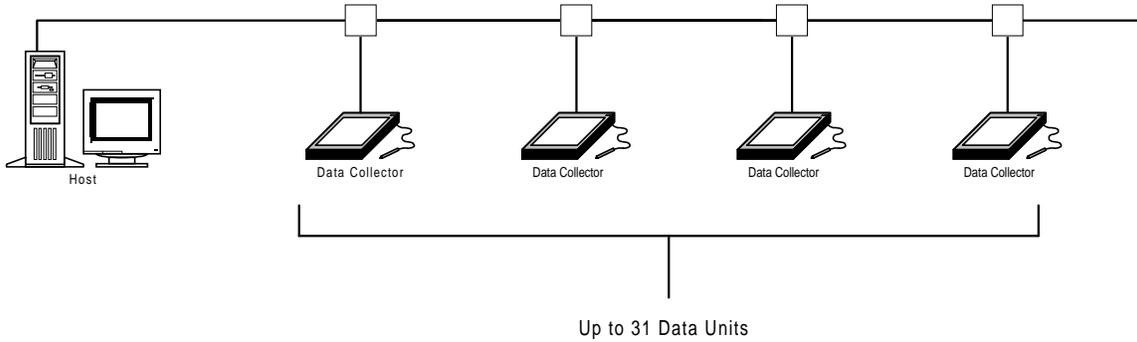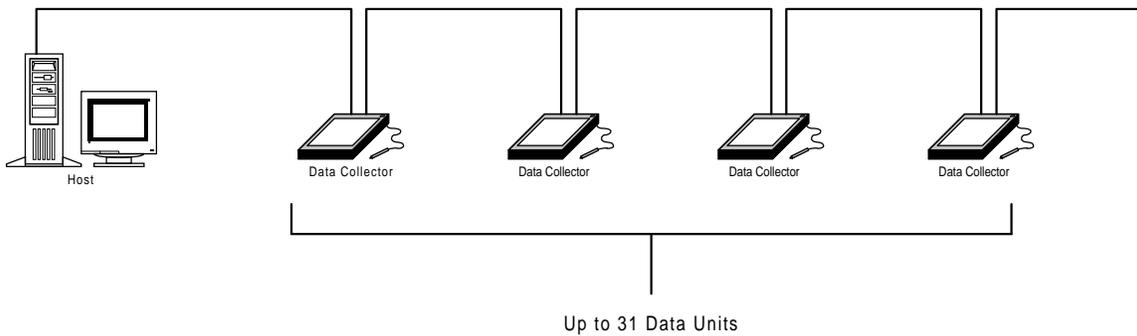
The former uses junction boxes and short stubs to simulate the daisy chaining of the units. The latter simply uses the parallel LAN ports provided by the Terminal units to allow the units to be daisy chained. Either layout offers the client differing features that need to be resolved prior to installation.
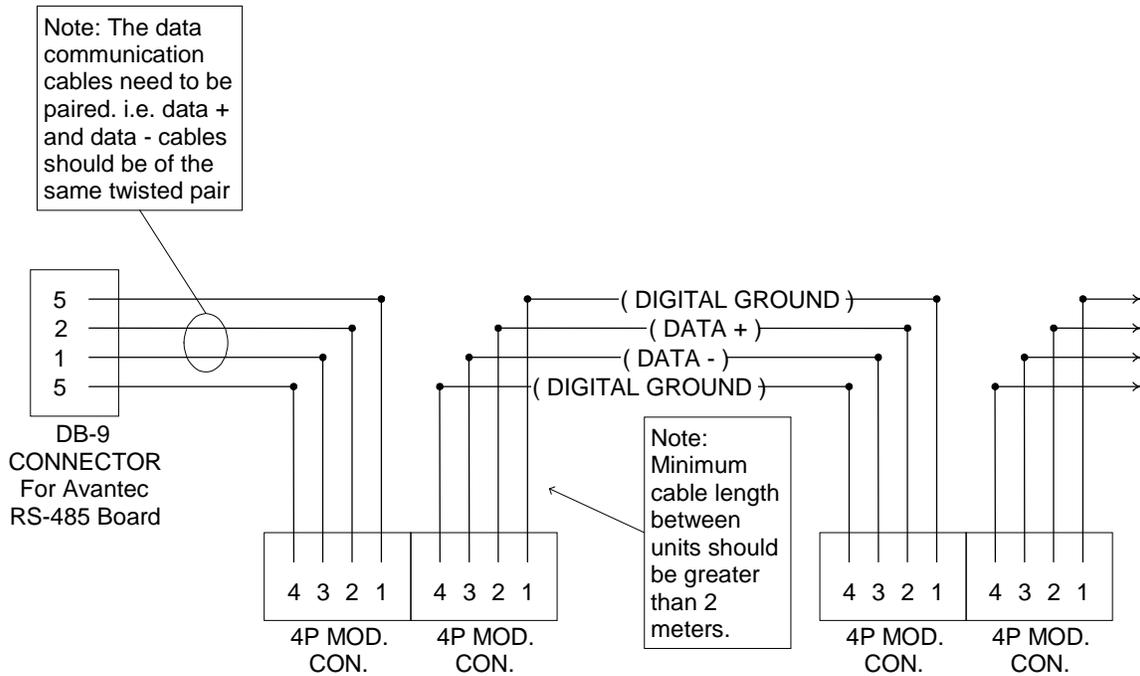
Specific Cabling requirements

The following two drawings detail the wiring requirements for the two scenarios shown in section on LAN Installation notes

Avantec RS-485

DB-9
CONNECTOR
For Avantec
RS-485 Board

Junction Box

(DIGITAL GROUND)
(DATA +)
(DATA -)
(DIGITAL GROUND)

Note: The data communication cables need to be paired. i.e. data + and data - cables should be of the same twisted pair

Note: Stub length should be no longer than 25 cm.

4P MOD. CON.

4P MOD. CON.

or

Note: The data communication cables need to be paired. i.e. data + and data - cables should be of the same twisted pair

DB-9
CONNECTOR
For Avantec
RS-485 Board

(DIGITAL GROUND)
(DATA +)
(DATA -)
(DIGITAL GROUND)

Note: Minimum cable length between units should be greater than 2 meters.

4P MOD. CON.

B&B Electronics RS-485/232 Converter

RJ-11
CONNECTOR
For B&B Electronics
RS-485-232
Converter

Junction Box

4 — (DIGITAL GROUND)
5 — (DATA +)
2 — (DATA -)
4 — (DIGITAL GROUND)

Note: The data communication cables need to be paired. i.e. data + and data - cables should be of the same twisted pair

4 3 2 1
4P MOD. CON.

Note: Stub length should be no longer than 25 cm.

4 3 2 1
4P MOD. CON.

or

Note: The data communication cables need to be paired. i.e. data + and data - cables should be of the same twisted pair

4
5
2
4

(DIGITAL GROUND)
(DATA +)
(DATA -)
(DIGITAL GROUND)

RJ-11
CONNECTOR
For B&B
Electronics RS-485-232
Connector

Note: Minimum cable length between units should be greater than 2 meters.

4 3 2 1   4 3 2 1
4P MOD. CON.   4P MOD. CON.

4 3 2 1   4 3 2 1
4P MOD. CON.   4P MOD. CON.

Termination Resistor

TERMINATION RESISTORS

Note: If used; two termination resistors of 120 Ohms each can be added to the network cable. The resistors should go between the Data + and the Data - wires only and be locate at or near the ends of the cable span. For cable spans or greater than 300 m termination resistors are required.
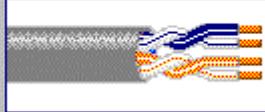
Cable Particulars

Belden Wire & Cable - [Multi Conductor Paired Cable:1]

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DataTwist® Three Horizontal/Backbone Cable
Unshielded Non-Plenum
24 AWG, 2 Pairs

Belden
1-800-BELDEN-1

Trade Number Industry Stds.	Std. Lgth. (ft.)	Std. Unit (lbs.)	AWG (strand) Type (Nom. D.C.R.) Conductors	Shields	Insul Thick (Jkt Thick)	Nom. O.D.	Nom. Imp. (ohms)	Vel. of Prop.	Nom. Cap.
1227A1 NEC CMR CEC CMR	U-1000	8.9	24 (Solid) BC 27 ohms/M'		0.007 in.	0.14 in.	100	60 %	19 pF/ft*

| Description | Color Codes | Attenuation | Design Opt. |

Insulation:	S-R PVC
Jacket:	PVC
Plenum Version(s):	

24 AWG solid bare copper, S-R PVC insulated, twisted pairs, unshielded, Gray PVC jacket, sequentially marked at two foot intervals. See Color Code Chart 5. Third Party verified to TIA/EIA 568-A Category 3.
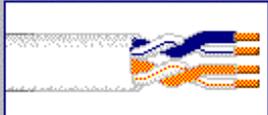
* Capacitance between conductors.

Belden Wire & Cable - [Multi Conductor Paired Cable:1]

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Belden
1-800-BELDEN-1

DataTwist® Three Horizontal/Backbone Cable
Unshielded Plenum
24 AWG, 2 Pairs

Trade Number Industry Stds.	Std. Lgth. (ft.)	Std. Unit (lbs.)	AWG (strand) Type (Nom. D.C.R.) Conductors	Shields	Insul Thick (Jkt Thick)	Nom. O.D.	Nom. Imp. (ohms)	Vel. of Prop.	Nom. Cap.
1243A2 NEC CMP CEC CMP	U-1000	10.2	24 (Solid) BC 27 ohms/M'		0.008 in.	0.14 in.	100	60 %	19 pF/ft*

| Description | Color Codes | Attenuation | Design Opt. |

Insulation:	LS PVC
Jacket:	LS PVC
Plenum Version(s):	

24 AWG solid bare copper, Low Smoke PVC insulated, twisted pairs, unshielded, White LS PVC jacket, sequentially marked at two foot intervals. See DataTwist® Color Code Chart. Third Party verified to TIA/EIA 568-A Category 3.
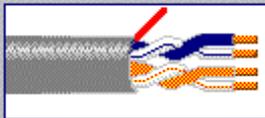
* Capacitance between conductors.

Belden Wire & Cable - [Multi Conductor Paired Cable:1]

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Belden

1-800-BELDEN-1

DataTwist® Five Horizontal/Backbone Cable
Unshielded Non-Plenum
24 AWG, 2 Pairs

Trade Number Industry Stds.	Std. Lgth. (ft.)	Std. Unit (lbs.)	AWG (strand) Type (Nom. D.C.R.) Conductors	Shields	Insul Thick (Jkt Thick)	Nom. O.D.	Nom. Imp. (ohms)	Vel. of Prop.	Nom. Cap.
1588A NEC CM CEC CM	1000 U-1000 1640 3000	14.8 14 23.1 44.6	24 (Solid) BC 26 ohms/M'		0.0075 in.	0.183 in.	100	70 %	15 pF/ft*

| Description | Color Codes | Attenuation | Design Opt. |

Insulation:	Polyolefin
Jacket:	PVC
Plenum Version(s):	

24 AWG solid bare copper, polyolefin insulated, twisted pairs, unshielded, ripcord. Light Gray or Blue PVC jacket, sequentially marked at two foot intervals. See DataTwist® Color Code Chart. Third Party verified to TIA/EIA 568-A Category 5.

For NEC/CEC CMG version, order Part No. 1588C.
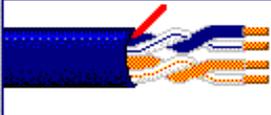
* Capacitance between conductors.

Belden Wire & Cable - [Multi Conductor Paired Cable:1]

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DataTwist® Five Horizontal/Backbone Cable
Unshielded Plenum
24 AWG, 2 Pairs

Belden
1-800-BELDEN-1

Trade Number Industry Stds.	Std. Lgth. (ft.)	Std. Unit (lbs.)	AWG (strand) Type (Nom. D.C.R.) Conductors	Shields	Insul Thick (Jkt Thick)	Nom. O.D.	Nom. Imp. (ohms)	Vel. of Prop.	Nom. Cap.
1590A NEC CMP CEC CMP	1000 3000	15.5 50.4	24 (Solid) BC 26 ohms/M'		0.007 in.	0.165 in.	100	75 %	15 pF/ft*

| Description | Color Codes | Attenuation | Design Opt. |

Insulation:	FEP Teflon
Jacket:	Flamarrest
Plenum Version(s):	

24 AWG solid bare copper, FEP Teflon® and/or Flame retardant polyolefin insulated, twisted pairs, unshielded, ripcord. Natural or Blue Flamarrest® jacket, sequentially marked at two foot intervals. See DataTwist® Color Code Chart. Third Party verified to TIA/EIA 568-A Category 5.

* Capacitance between conductors.