

Intelli-DART™

Intelligent Digital Analog Remote Transducer

Operation / Installation Manual

Manual Part Number: A8M5019

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1.0 SYSTEM OVERVIEW

1.1 General Overview

The Intelli-DART™ Sensor (A3A0217) is a lightweight; compact, multi-sensor unit designed for monitoring and telemonitoring service purposes in a welding environment. The Intelli-DART™ Transducer includes an embedded micro-controller to provide the necessary data acquisition, signal processing and communications firmware to allow remote logging of the following basic welding parameters.

- Arc Current
- Arc Voltage
- Wire Feed Speed
- Shielding Gas Pressure

The light weight, easy to install design allows the user to install the Intelli-DART™ at the wire drive motor inlet using industry standard quick disconnect conduit fittings or to a fixed surface with the optional mounting brackets (A2A0025). The LED indicators provide the operator or maintenance personnel with a quick visual indication of sensor activity.

The unit is powered by a user supplied external 24 VDC power source via the sensor interface cable (A3W0327). This cable also provides the Analog and TTL Signal Outputs to an external system (data acquisition or PLC).

1.2 General Specifications

Listed below are the general system specifications:

Dimensions:	3.81" H x 5.38" W x 5.25" L (97mm x 137mm x 133mm)
Weight:	2.7 lbs (1.2 kg)
Power Input:	24 vdc @ 0.2 amp, ripple 200 mv
Operating Temp:	-12°C to +60°C
Remote Input:	5 – 24 vdc @10ma current limited
Serial Communication	Modbus™ RTU slave mode protocol

1.3 Sensor Specifications

Current sensor	
Current range	0-600 A (DC)
Relative precision on Range	± 1%
Max Linearity error	± 0.9 % of reading
Band Width at ±1db	2.5 KHz

Voltage sensor	
Voltage range	0-100 V (DC)
Relative precision on Range	± 1%
Max Linearity error	± 0.5 % of reading
Band Width at ±1db	2.5 KHz

Pressure sensor	English Units	Metric Units
Pressure range	2.5 – 14.5 PSI	15 – 100 Kpa
Relative precision on Range	± 3%	± 3%
Max Linearity error	± 1.8 % of reading	± 1.8 % of reading
Band Width at ± 1db	250 Hz	250 Hz

Wire speed sensor	English Units	Metric Units
Wire diameter (min/max)	.030 - .062 inch	0.8 mm / 1.6 mm
Speed range	10 – 1000 ipm	4 – 420 mm/s
Relative precision on Range	± 3%	± 3%

2.0 INSTALLATION

2.1 General Guidelines

The Intelli-DART™ can be mounted two different ways. It can be installed at the wire feeder using the quick disconnect fittings or mounted to a fixed surface. Listed below are some things that should be taken into consideration when selecting a place and method for mounting of the Intelli-DART™:

- Mount the Intelli-DART™ in a location that is convenient for installation of the welding wire and will not cause any binding of the wire or the wire liner. It is recommended that the Intelli-DART™ be mounted as close to the wire feeder as possible (**not to exceed 1 meter**).
- The Positive welding cable must pass through the Intelli-DART™ sensor opening. Make sure that there is no stress on the sensor as a result of movement of the welding cable.
- The Shielding Gas line must be attached to the gas inlet of the sensor. Consideration must be given to the routing of the Shielding Gas hose to prevent any restriction of gas flow.
- The Sensor cable must be mounted in such a manner as to prevent stress on the sensor cable connector.
- The two 18 gage conductors supplied with the Intelli-DART™ are used to provide the + and – of the Voltage Sense. These conductors must be routed so as not to produce stress on the Voltage Sense terminal strip.
- When mounting the Intelli-DART™, position it so the operator or maintenance personnel can see the sensor LEDs if possible.
- If using the optional mounting brackets to mount the Intelli-DART™, an insulating liner must be used for support of the wire from the sensor to the back of the wire feeder inlet guide.

2.2 Sensor Installation Guidelines

Installation of the Intelli-DART™ is a simple 5-step process regardless of the selected mounting method.

1. Feed the Positive welding cable through the Intelli-DART™ Current Sensor opening. The diameter of the opening will accommodate a 22 mm cable. If the crimp terminal is too large to fit through the opening then it must be removed and another terminal installed after the cable is passed through the opening.
2. Feed the wire through the Intelli-DART™ Wire Feed Speed Sensor inlet. Push down on the pressure release lever located on the top of the sensor while feeding the wire through the guide rollers and out the other side of the sensor. Feed the wire into the wire drive motor as you would normally. If using the quick disconnect fittings to mount the sensor, connect one end to the wire drive motor quick disconnect fitting. Insert the wire liner quick disconnect fitting into the other end of the sensor. If using the **optional mounting brackets**, install the sensor at the desired location. Install an insulated wire liner or conduit assembly (Maximum length of 1 meter) for support of the wire from the Intelli-DART™ to the wire feeder inlet.
3. Connect the Shielding Gas line to the Intelli-DART™ Gas inlet. A barb T-fitting is provided to facilitate the installation of the Gas Line. Install the Barb T-Fitting in the gas line on the TORCH side or outlet side (**Low Pressure** side) of the GAS Solenoid. Installing the Barb T-Fitting on the inlet side (**High Pressure** side) of the GAS Solenoid can result in an over pressure of the sensor and possible **damage** to the **GAS Sensor**. Cut the Gas hose and install each end on to the 1/8" NPT 90° elbow. User to supply the necessary adaptor. Make sure to check for gas leaks after the hose clamps are installed.
4. Use the two Conductors (18 gage, 600V) provided with the Intelli-DART™ Sensor to connect the Intelli-DART™ Voltage Sensor to the welding system. Route the RED conductor (3' long) from the Positive (+) terminal of the Voltage Sense Terminal block to the Positive welding cable connection point (at the Torch or Wire Feeder). Route the BLACK conductor (25' long) from the Negative (-) terminal of the Voltage Sense Terminal block to the Negative welding cable connection point (at the Work piece ground point).
5. To connect the Sensor Cable (A3W0327) to the Intelli-DART™, insert the connector into the Intelli-DART™ Sensor Cable receptacle until it "Clicks" and locks into place. Connect the other end to the appropriate weld data acquisition system or PLC. To remove the Intelli-DART™ Sensor Cable, pull back on the locking barrel of the connector plug

while pulling the plug from the receptacle. A diagram of the connections for the cable can be found in Appendix B.

2.3 Configure Modbus™ Device ID

Two BCD switches are provided to allow external definition of 0 to 255 MODBUS addresses. Prior to operation the user must set the desired Device ID number for the Modbus communications. Each address must be unique. To set the Device ID remove the Black hole plug from the bottom of the unit. Locate the LSB and MSB rotary switches. Set the binary address by rotating the switches to the desired address. The Switch is Binary encoded and has a range of "0 - F". Reinstall the hole plug after setting the Device ID number. The maximum Device ID is restricted to 247 as specified by the Modbus Protocol standard. See Appendix C for Device ID MSB and LSB Decode Table.

3.0 OPERATION

3.1 Arc Detection

A 24-vdc input has been provided to allow an external 24-vdc source to provide a remote Arc On condition. When this input is asserted, the sensor will begin data logging and will continue until the input is reset. The user must activate this input by setting the corresponding mode via the serial communication port. If the “Remote Arc On” mode is disabled the sensor will use the Arc Voltage and Current to determine when to log welding data. Both parameters must exceed the user defined threshold values to set an “Arc On” condition. When the Voltage or Current falls below the user specified value the sensor would set an “Arc Off” condition and stop data logger.

3.2 Embedded Firmware

The embedded firmware has basic scaling and averaging capabilities as well as Slave mode ModBus RTU Communications protocol support. The sensor will provide user defined average and data collection mode to allow Run time and/or average data storage. The Run time data will be generated based on the averaging sample time specified by the user. The Raw analog data will be sampled at a 5 kHz rate. The Sensor will average 5 samples to produce a 1kHz data rate for all analog sensors. The Wire feed conversion time will be based on the actual wire feed rate (16.6 Hz – 16.6 KHz).

Configuration of scaling and averaging parameters will be possible through the ModBus network port. The user may specify the number of samples (X) to be averaged before saving the data point in memory for later play back. The SENSOR will also generate a weld summary for each weld, which will be the average of all sampled data during the last weld cycle. The Data will be Date/Time stamped and stored in NV-RAM. Up to 1300 weld summaries may be stored before downloading. The sensor provides continuous averaging of the X most recent data values, and queries by the host system at lower frequencies of either last data value or last average value.

3.3 Host System Interface

The sensor will provide a RS-485 compatible serial port and will support the ModBus RTU protocol. The following baud rates are supported 1200, 2400, 4800, 9600, 19.2K and 38.4K. The Baud rate is user selected. The default baud rate is 19.2K.

The following is the general specification for the RS-485 port:

Serial	
Physical support	Twisted Pair
Connector	Lemo 5 pin circular
Network	RS 485 – Half Duplex
Data exchange protocol	Modbus RTU

The RS-485 is a Turck Eurofast connector and will provide the RS-485 connections and the power to operate the sensor. The sensor provides a user configurable 120-ohm termination resistor for the RS-485 serial cable. The Host controller will provide the necessary power to operate the sensor. The power will be connected to the sensor through the RS-485 cable. The sensor requires an input voltage of 12 – 36 vdc @ 3.6 watts. The sensor will provide polarity and over current protection. The sensor terminal connector will Pin out as follows:

Pin	Function
1	Sensor (12 – 24 vdc) Positive Input
2	Net_High RS-485 Signal High
3	Net_Low RS-485 Signal Low
4	Arc Active Input (5 – 24 vdc)
5	Sensor (12 – 24 vdc) Common

4.0 Intelli-DART™ MODBUS MEMORY MAP

4.1 General Description

This document provides the basic Modbus memory map and command structure for the Intelli-DART™ RS-485 communications port. The Intelli-DART™ supports the Modbus Protocol as specified in the Modicon Technical publications “Modbus Protocol” (intr7.html). The Intelli-DART™ control does not support the Broadcast mode. The controller provides the slave side communications routines for the RTU mode. The user must define the Slave ID to a unique ID number from 1 – 247. Default Baud rate is 19.2 K baud.

4.2 Supported ModBus Commands

The following ModBus commands are supported:

CODE	DESCRIPTION	ADDRESS RANGE
01	Read Coil Status	0-15
03	Read Holding Registers	0-21
05	Force Single Coil	0-15
06	Preset Single Register	0-21
15	Force Multiple Coils	0-15
16	Preset Multiple Registers	0-21
17	Report Slave ID	5 bytes

4.3 Memory Map for Sensor

The following is the Coil definitions address 0-15:

COIL	ADDRESS	DESCRIPTION
1	0	Arc Active – Set when Weld Arc is detected
2	1	Save Average Data – When set Weld Summary Data is stored in NVRAM
3	2	Clear Weld Counter – When set the Weld Counter will be reset to 1
4	3	Clear Summary Counter – When set the Average Data Counter is reset to 0 and Average Memory is cleared
5	4	Clear Arc Timer – When set the Accumulative Arc Timer is reset to 0
6	5	Disable Auto Arc Detect – When set the Arc On condition must be set by the user supplied input or Setting Coil 1
7	6	Read Memory – When set the Weld Summary data specified by Register 19 will be read into Register 2-12. Coil will be reset when summary has been loaded. Function is executed only when the arc is off.
8	7	Set Clock – When set the Date and Time values set in Register 7 – 12 will be loaded to the Real Time Clock. The Coil will be reset after the RTC is set. This function will only execute when the arc is off.

9	8	Enable Metric units of measure (1=Metric, 0=Imperial)
10-16	9-F	Not Defined – For future use

The following is the Register definitions address 0-21:

REGISTER	ADDRESS	DESCRIPTION
1	0	Arc On Status – When the arc is active the value will be 1 when the arc is off the value will be 0
2	1	Arc Time – Weld on timer in 0.1-second intervals. Value is incremented during a weld cycle and measures the Arc On time for each weld. When the weld cycle is complete the total time for the weld will be set. (Note 100 = 10.0 sec)
3	2	Volts – During the Arc on Time the value represents the actual arc voltage. The value is in 0.1-volt increments (100=10.0 volts). When the weld cycle is complete the value will be the statistical average for the last weld.
4	3	Amps- – During the Arc on Time the value represents the actual arc current. The value is in 1amp increments (100=100 amps). When the weld cycle is complete the value will be the statistical average for the last weld.
5	4	Gas Pressure - – During the Arc on Time the value represents the actual gas pressure. The value is in 1KPa increments (100=100KPa). When the weld cycle is complete the value will be the statistical average for the last weld.
6	5	Wire Speed - – During the Arc on Time the value represents the actual wire feed speed. The value is in 1-mm/sec increments (100=100 MM/Sec). When the weld cycle is complete the value will be the statistical average for the last weld.
7	6	Hour – The value is the arc start Hour based on the Real Time Clock. This value is set when an arc on condition is detected.
8	7	Minute - The value is the arc start minute based on the Real Time Clock. This value is set when an arc on condition is detected.
9	8	Second - The value is the arc start second based on the Real Time Clock. This value is set when an arc on condition is detected.
10	9	Day - The value is the arc start day based on the Real Time Clock. This value is set when an arc on condition is detected.
11	10	Month - The value is the arc start month based on the Real Time Clock. This value is set when an arc on condition is detected.
12	11	Year – The value is the arc start year based on the Real Time Clock. This value is set when an arc on condition is detected.
13	12	Total ARC Hours – This value is the accumulative arc on hours since the last arc time reset.
14	13	Total ARC Minutes - This value is the accumulative arc on minutes since the last arc time reset.

15	14	Total Arc Seconds - This value is the accumulative arc on seconds since the last arc time reset. Value is in 0.1 second increments (100=10.0 seconds).
16	15	Weld Count – Total number of weld since last reset. If weld counter reaches the max count of 65535 the counter will reset to 0.
17	16	Weld Summary Count – Value indicates the number of weld summaries stored in memory (Max Count = 500).
18	17	Sample Count – Value indicates the number of raw data samples to average to produce a single sample value as stored in Register 3-5.
19	18	Read Weld Number – the value is used to select the stored Summary data to be read from memory to Register 2-12. Range of Value 1-500.
20	10	Arc On Amps – The value set in this Register is the welding current that must be exceeded to establish an arc on condition. Value is in 1-amp increments (10 = 10 amps).
21	20	Arc On Volts - The value set in this Register is the welding voltage that must be exceeded to establish an arc on condition. Value is in 0.1-volt increments (100 =10.0 volts).

The following is a summary of the Report Slave ID and Status (Code 17) Response Data fields:

Byte	Contents
1	Sensor ID Number =10 Hex (Version 1, Rev0)
2	Run Indicator (0=OFF, FF=On)
3	Status Byte Bit 0 = Ram Full Bit 1 = Battery Ok Bit 2 = Self Test Ok Bit 3-7 = 0
4	Firmware Version Number – BCD Format (MSB = Major: LSB = Minor)
5	Firmware Version Number – BCD Format (MSB+LSB = Release)

4.4 Coil Definitions and Operation

The Intelli-DART™ has 16 simulated output coils. These coils are used as internal bit flags to perform specific functions. Only 1-8 of the simulated coils is used. Setting the coils 8-16 will not have any effect on the Intelli-DART™ controller. However, they are reserved for future expansion. The Intelli-DART™ support both single and group force coil commands. Refer to Section 4.3 for summary of the Coil functions.

To clear the Intelli-DART™ weld and average counters or reset the total arc timer, force the specific coil to the “ON” condition. The Intelli-DART™ will clear the requested counter or timer and then reset the coil to the “OFF” condition signifying a successful operation.

To disable the auto arc on detection mode force coil 2 to the “ON” condition. When set the Intelli-DART™ will only log data when the remote on input is active. To allow normal arc on detection Coil 2 must be in the “OFF” condition.

To set the Real time clock perform the following steps:

1. Set Coil 2 to the “ON” condition to disable automatic arc detection.
2. Load the BCD formatted Time and Date into the value Registers 6-12.
3. Set Coil 8 to the “ON” condition. The Intelli-DART™ will clear the coil after completing the function.
4. Enable Coil 2 to resume automatic arc detection.

To read a stored weld data summaries perform the following steps:

1. Set Coil 2 to the “ON” condition to disable automatic arc detection.
2. Load the desired weld summary number into Registers 19. This value must be equal to or less then the total number of saved welds as indicated by Register 17.
3. Set Coil 6 to the “ON” condition. The Intelli-DART™ will load the stored data into Registers 2-12 and will clear the coil after completing the function. The data will remain in the register until the next arc on or stored weld request.
4. Enable Coil 2 to resume automatic arc detection.

4.5 Register Definitions

Register 1: Used to indicate when a welding arc has been detected. When this register is a 1 the Intelli-DART™ controller is updating the welding parameters with new measured values.

Register 2–6: Contains the current value for each of the welding parameters: The following table shows the value and units of measure for each weld parameter register:

REGISTER	MEASURED PARAMETERS	UNITS OF MEASURE
2	Arc On time – Time in 0.1 seconds from arc detection	(Value /10) sec.
3	Arc Voltage – Voltage measured by Volt sensor	(Value/10) vdc
4	Arc Current – Welding amps measured by Hall Sensor	Value = Amps DC
5	Gas Pressure – Shielding Gas pressure from Torch	(Value * 0.44)=Kpa
6	Wire Speed – Linear wire speed measured by encoder	Value = mm/sec

When the Arc is in the off condition the Registers will display the statistical average for the last weld.

Registers 6-12: Contains the Time and Date at the start of the last weld. These registers will only update when a new weld is detected or a weld summary is loaded from memory. The Time and Date parameters are in BCD format. The low nibble is the 1's units and the upper nibble is the 10's units. Only the lower byte is used for all parameters except the year. The MSB byte holds the BCD value for the century value.

Note: When setting the Real time Date and Time the values loaded into the Registers 6-12 must be in a BCD format.

Register 13–15: Used to indicate the accumulative arc time. The value is an integer value and represents the total arc on time sense the last reset. At the end of each weld the accumulated arc timer will be updated. Writing to these registers will have no effect on the total arc time. When the next weld occurs the new value will be written.

Register 16: The current weld count sense the last weld count reset. This counter is incremented when the total arc time for a weld is greater then 0.5 seconds. This prevents false arc starts from being counted as a valid weld.

Register 17: Indicates the number of weld summaries stored in the weld memory. The maximum number of welds stored is 1365. Writing a new value to this register will cause the next collected weld to be written to that weld number location. The Welds will only be saved if the Save Weld summary coil (2) has been set and the minimum weld time is greater than 0.5 seconds.

Register 18: This register sets the number of raw data points to be averaged to generate a single sampled value. The minimum value is 1 and the maximum value is 255. Setting this value to 0 will disable the Analog Data collection routines.

Register 19: This register is used to read a previously stored weld summary from memory. Set the desired weld summary number in this register then set the Read Weld Memory Coil 7. The value will be written to Register 2 – 12. Maximum value is 1365.

Register 20-21: These registers are used to specify the conditions required to establish an arc on signal. To set the auto arc on signal the Voltage and current sensor values must exceed both values stored in the these registers. If any single sensor input drops below this level the arc on signal will be reset.

5.0 Intelli-DART™ ASCII TERMINAL MODE PROTOCOL

5.1 General Description

If the Device ID is set to zero when the power is applied then the Intelli-DART™ Terminal mode is active and can be used to off-line program the user configurable parameters and operating modes. The protocol is a simple ASCII command string that allows the user to upload or download the various data. The user can use any terminal program to perform the programming function. All program command functions are case sensitive. The serial port is configured for the following data format:

- Baud Rate: 19.2K, Full Duplex
- Word Length: 8 Data Bits, One Stop and no parity
- Hand Shaking: None

5.2 TERMINAL PROTOCOL

The protocol consists of a command string and optional data bytes. The command string is an alpha character and an option number followed by a "=" or "?", followed by optional data and terminated with an ASCII "cr" (0dh). The "=" will indicate that data is being sent to the selected parameter by the host controller. The "?" will indicate a request for data from the Intelli-DART™ to the host controller. If the host is sending data to the Intelli-DART™ the data will be placed after the "=" character and will be an ASCII string terminated with an ASCII "cr" (0dh). The following is an example of reading a parameter value from the Intelli-DART™:

From Host type: **V1? (cr)**
Response from Intelli-Dart™: **##**

Where: ## is the current value for the parameter and (cr) is the enter key

The following is an example of how to modify a value in the Intelli-DART™ using the terminal commands:

From Host type: **V1=#### (cr)**

Where: ## is the new value for the parameter and (cr) is the enter key

The following is a summary of the two special command functions. They are used to set and read the Intelli-DART™ Real time Clock (RTC). To read the current Time type the following command:

From Host type: **T? (cr)**
Response from Intelli-Dart™: **hh:mm:ss**

Where: hh is the current hour, mm is the current minute and ss is the current second. (cr) is the enter key

To set the time (hour/minute/second) type: **T=10:17:35** (cr) Entire field must be completed as explained below:

Type 6:45 am as **T=06:45:00** (cr)

Type 7:25 PM as **T=19:25:00** (cr)

Note: "cr" denotes carriage return (Enter)

To read the current Date type the following command:

From Host type: **D? (cr)**

Response from Intelli-Dart™: **mn:dd:yy**

Where: mn is the current month, dd is the current day and yy is the current year, (cr) is the enter key

To set the date (year/month/day) type: **D=99/06/01** (cr). The Entire field must be completed as explained below:

Type February 4, 1999 as **D=99/02/04**(cr)

Type November 23, 2000 as **D=00/11/23**(cr)

Note: "cr" denotes carriage return (Enter)

5.3 TERMINAL COMMANDS

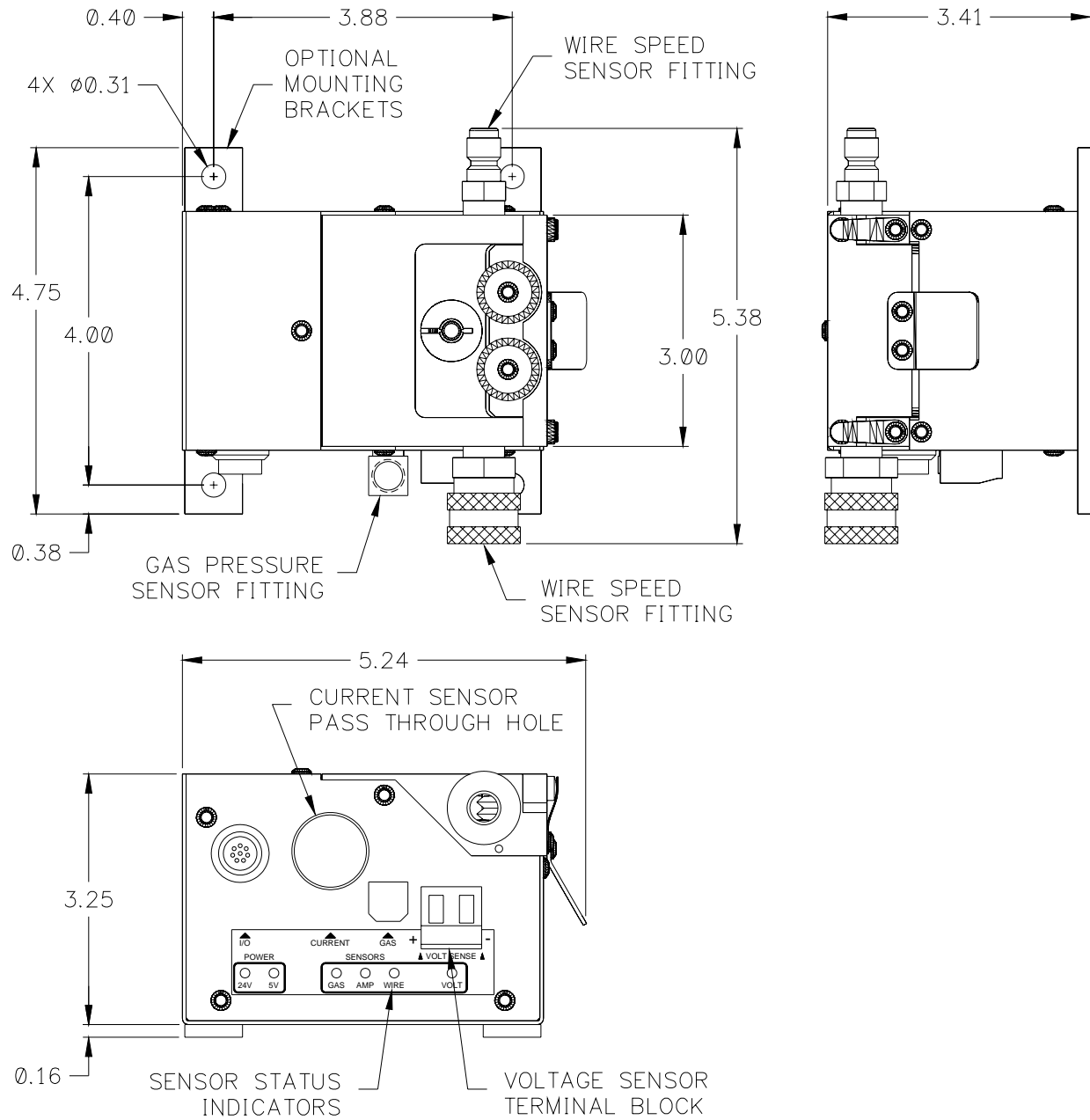
The following is a summary of the Terminal Commands supported by the Intelli-DART™:

Command	DESCRIPTION	RANGE
C0	Voltage zero offset calibration value. (128 = 0 offset) Negative offset < 128 > Positive offset	0-255
C1	Current zero offset calibration value (128 = 0 offset) Negative offset < 128 > Positive offset	0-255
C2	Gas Pressure zero offset calibration value (128 = 0 offset) Negative offset < 128 > Positive offset	0-255
C3	Gas pressure Gain value (Gain = Value/32)	0-255
D	Sets or reads the Real Time Clock date parameters Format = YY/MM/DD	8 Bytes
T	Sets or Reads the Real Time Clock Time parameters Format = HH:MM:SS	8 Bytes
M0	Modbus Coils 1-8 Set/Read. Binary Bit's are set by decimal value. CR1=1, CR2=2, CR3=4, CR4=8, CR5=16, CR6=32, CR7=64, CR8=128	0-255
M1	Modbus Coils 9-16 Set/Read. Binary Bit's are set by decimal value. CR1=1, CR2=2, CR3=4, CR4=8, CR5=16, CR6=32, CR7=64, CR8=128	0-255
M2	Baud Rate – Sets the serial communications Baud Rate 2=38.4Kbaud, 3 = 19.2Kbaud, 4=9600baud	2-4
M3	Operational Mode. Binary Bit's are set by decimal value. BITS 1..7 not used	0-255
V0	Arc On Status – When the arc is active the value will be 1 when the arc is off the value will be 0	0-1
V1	Arc Time – Weld on timer in 0.1-second intervals. Value is incremented during a weld cycle. And measures the Arc On time for each weld. When the weld cycle is complete the total time for the weld will be set. (Note 100 = 10.0 sec)	0-65535
V2	Volts – During the Arc on Time the value represents the actual arc voltage. The value is in 0.1 volt increments (100=10.0 volts). When the weld cycle is complete the value will be the statistical average for the last weld.	0-1023
V3	Amps- – During the Arc on Time the value represents the actual arc current. The value is in 1amp increments (100=100 amps). When the weld cycle is complete the value will be the statistical average for the last weld.	0-1023
V4	Gas Pressure - – During the Arc on Time the value represents the actual gas pressure. The value is in 1KPa increments (100=100KPa). When the weld cycle is complete the value will be the statistical average for the last weld.	0-2032
V5	Wire Speed - – During the Arc on Time the value represents the actual wire feed speed. The value is in 1-mm/sec increments (100=100 MM/Sec). When the weld cycle is complete the value will be the statistical average for the last weld.	0-1000

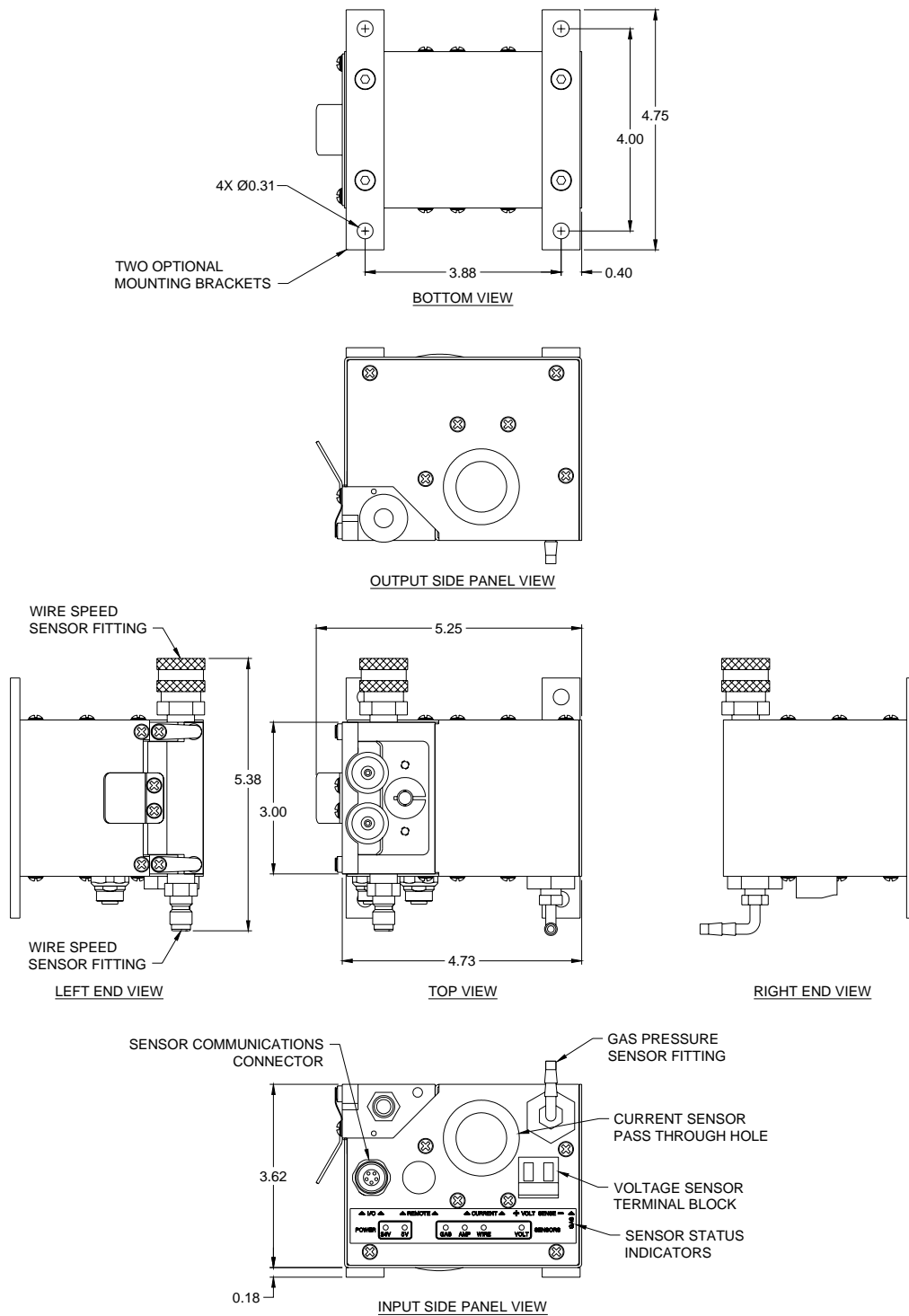
V6	Hour – The value is the arc start Hour based on the Real Time Clock. This value is set when an arc on condition is detected.	0-65535
V7	Minute - The value is the arc start minute based on the Real Time Clock. This value is set when an arc on condition is detected.	0-65535
V8	Second - The value is the arc start second based on the Real Time Clock. This value is set when an arc on condition is detected.	0-65535
V9	Day - The value is the arc start day based on the Real Time Clock. This value is set when an arc on condition is detected.	0-65535
V10	Month - The value is the arc start month based on the Real Time Clock. This value is set when an arc on condition is detected.	0-65535
V11	Year – The value is the arc start year based on the Real Time Clock. This value is set when an arc on condition is detected.	0-65535
V12	Total ARC Hours – This value is the accumulative arc on hours since the last arc time reset.	0-65535
V13	Total ARC Minutes - This value is the accumulative arc on minutes since the last arc time reset.	0-59
V14	Total Arc Seconds - This value is the accumulative arc on seconds since the last arc time reset. Value is in 0.1-second increments (100=10.0 seconds).	0-59
V15	Weld Count – Total number of weld since last reset. If weld counter reaches the max count of 65535 the counter will reset to 0.	0-65535
V16	Weld Summary Count – Value indicates the number of weld summaries stored in memory (Max Count = 500).	0-1365
V17	Sample Count – Value indicates the number of raw data samples to average to produce a single sample value as stored in Register 3-5.	0-255
V18	Read Weld Number – the value is used to select the stored Summary data to be read from memory to Register 2-12. Range of Value 1-500.	0-1365
V19	Arc On Amps – The value set in this Register is the welding current that must be exceeded to establish an arc on condition. Value is in 1-amp increments (10 = 10 amps).	0-1023
V20	Arc On Volts - The value set in this Register is the welding voltage that must be exceeded to establish an arc on condition. Value is in 0.1-volt increments (100 =10.0 volts).	0-1023

Appendix A Intelli-DART™ Installation Specifications

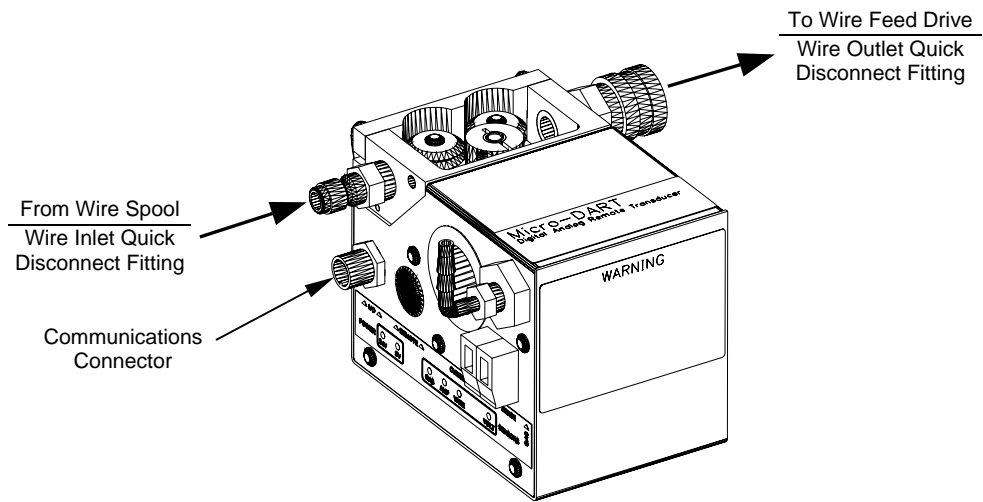
A.1 Intelli-DART™ Sensor (Rev. 0) Mounting Dimensions



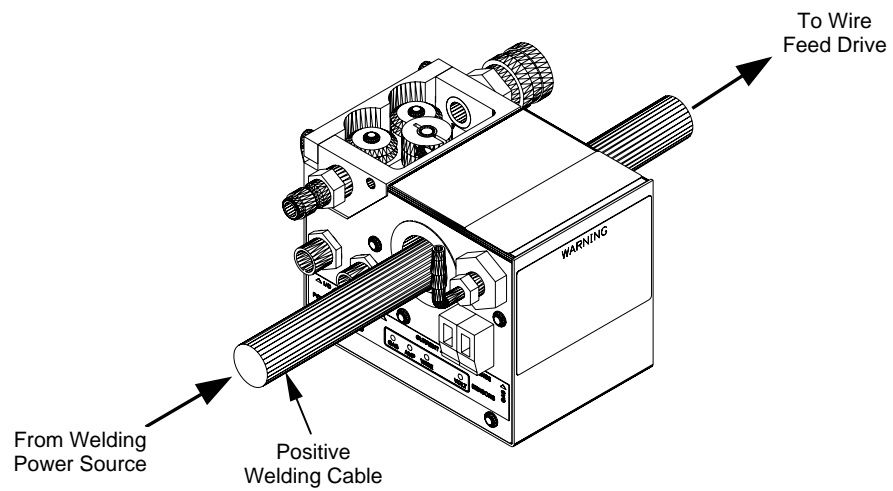
A.2 Intelli-DART™ Sensor (Rev. A) Mounting Dimensions



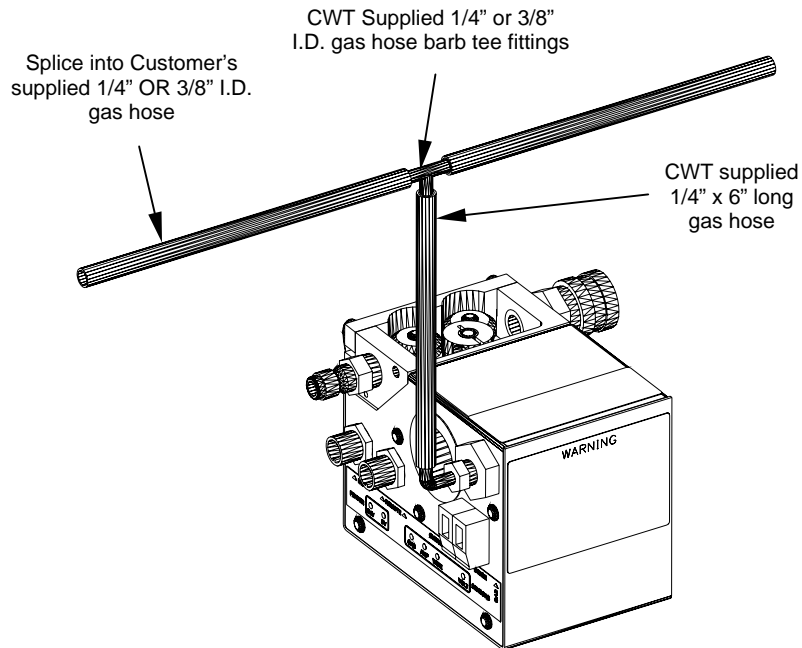
A.3 Sensor Cable and Wire Speed Sensor Installation



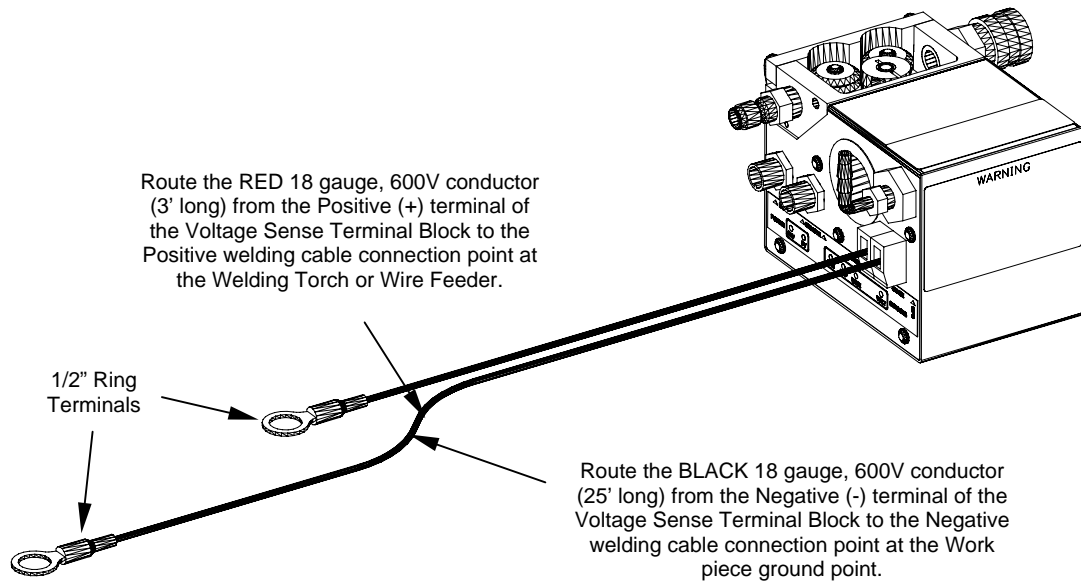
A.4 Positive Welding Cable Installation



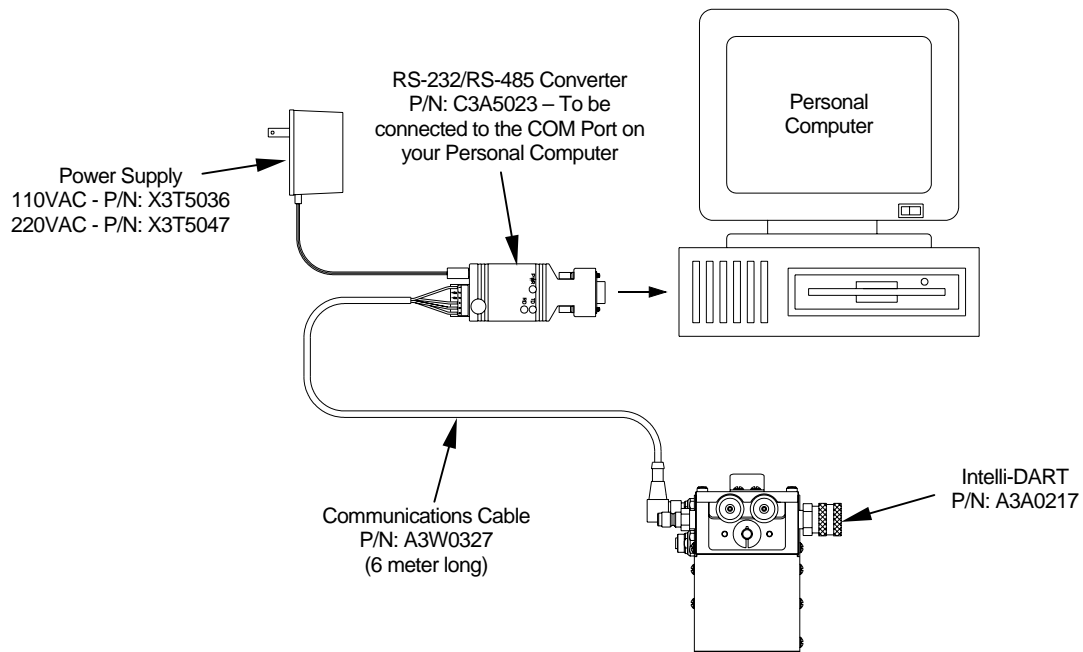
A.5 Gas Pressure Hose Installation



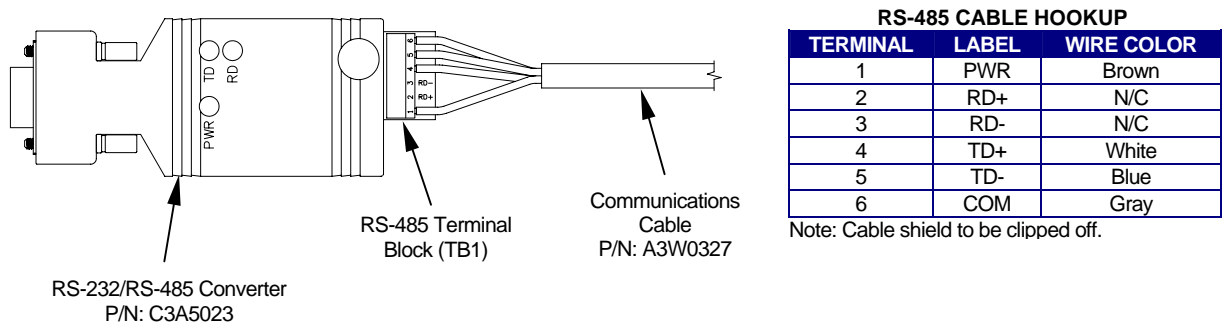
A.6 Voltage Sensor Installation



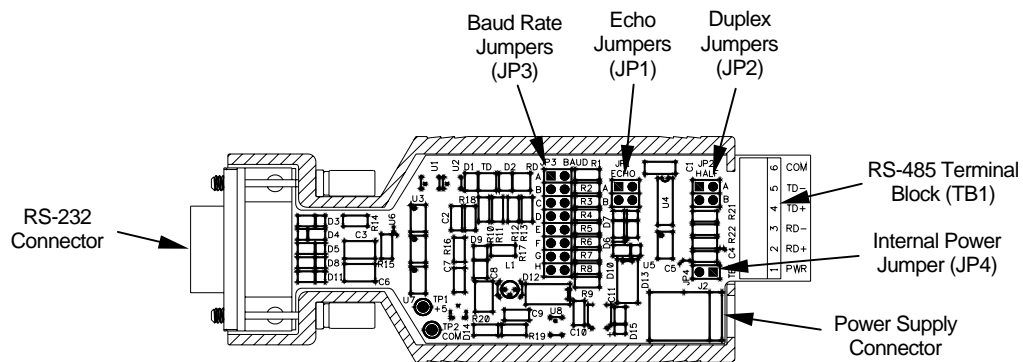
A.7 Single Unit Installation



SYSTEM INSTALLATION DIAGRAM



COMMUNICATIONS CABLE INSTALLATION DIAGRAM



ECHO JUMPERS (JP1)

ECHO	JUMPER
On	A
Off**	B

** Denotes the default jumper

DUPLEX JUMPERS (JP2)

DUPLEX	JUMPER
Full	None
Half**	A and B

** Denotes the default jumper

BAUD RATE JUMPERS (JP3)

BAUD	JUMPER
1200	A
2400	B
4800	C
9600	D
19200**	E
38400	F
57600	G
115200	H

** Denotes the default jumper

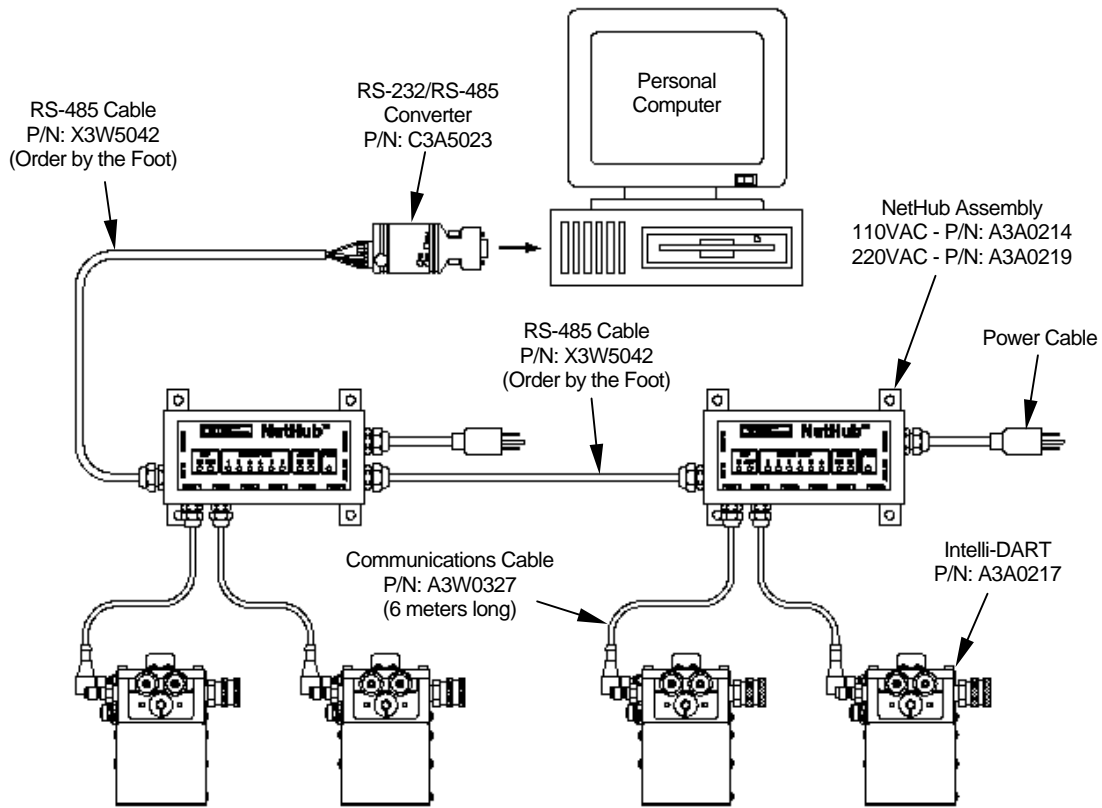
POWER JUMPERS (JP4)

POWER	JUMPER
External**	Yes
Internal	No

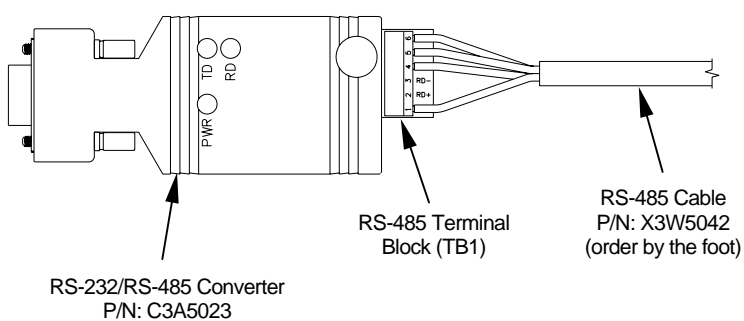
** Denotes the default jumper

RS-485/RS-232 CONVERTER JUMPER LOCATION DIAGRAM

A.8 Multiple Unit Network Installation



SYSTEM INSTALLATION DIAGRAM

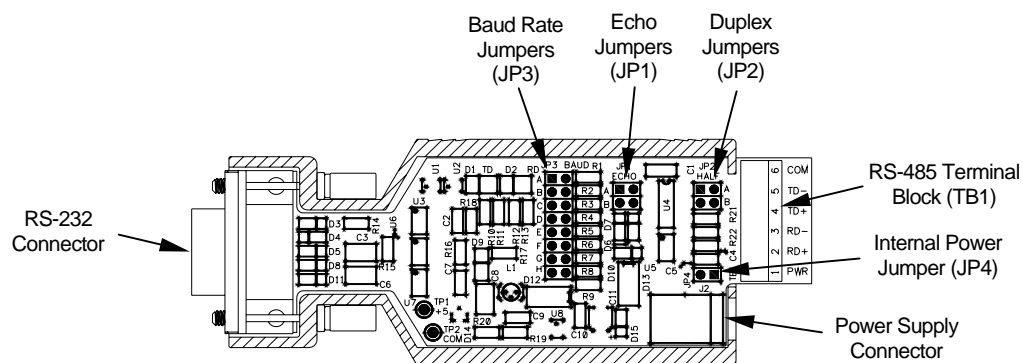


RS-485 CABLE HOOKUP

TERMINAL	LABEL	WIRE COLOR
1	PWR	Orange
2	RD+	N/C
3	RD-	N/C
4	TD+	Blue
5	TD-	White/Blue
6	COM	White/Orange

Note: Cable shield to be clipped off.

COMMUNICATIONS CABLE INSTALLATION DIAGRAM



ECHO JUMPERS (JP1)

ECHO	JUMPER
On**	A
Off	B

** Denotes the default jumper

DUPLEX JUMPERS (JP2)

DUPLEX	JUMPER
Full**	None
Half	A and B

** Denotes the default jumper

BAUD RATE JUMPERS (JP3)

BAUD	JUMPER
1200	A
2400	B
4800	C
9600	D
19200**	E
38400	F
57600	G
115200	H

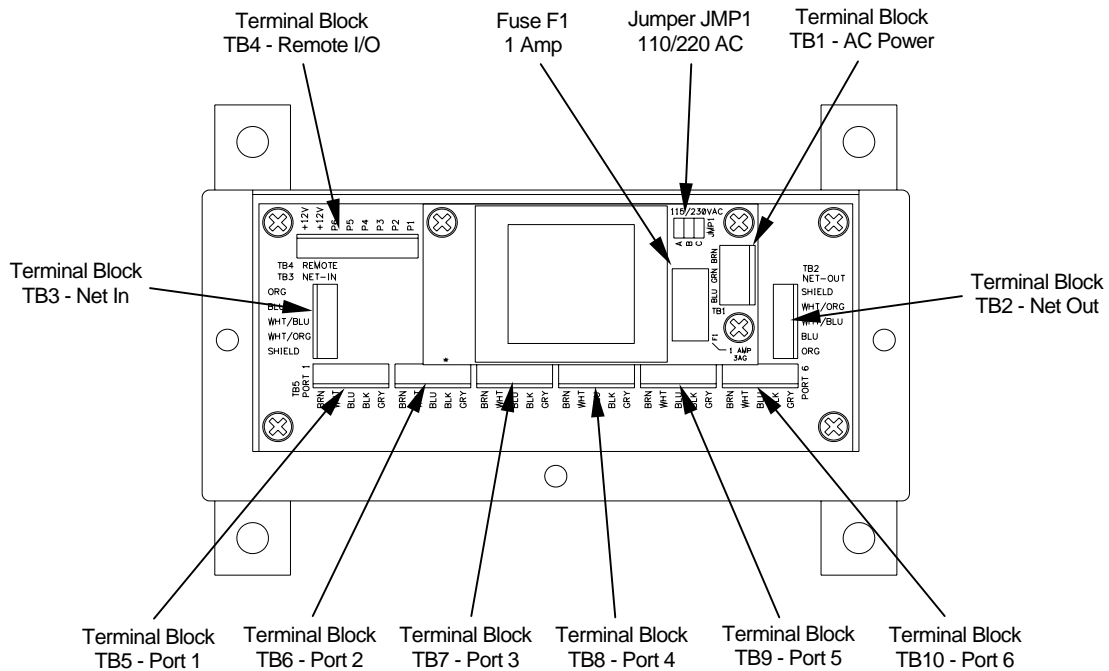
** Denotes the default jumper

POWER JUMPERS (JP4)

POWER	JUMPER
External**	Yes
Internal	No

** Denotes the default jumper

RS-485/RS-232 CONVERTER JUMPER LOCATION DIAGRAM



JUMPER JMP1 - 110/220VAC

VOLTAGE	JUMPERS
110VAC	A and B
220VAC	C

The next two jumpers (JP1 and JP2) are for whether the RS-485 Converter is powered from an external power source or uses the power supplied by the NetHub.

JUMPER JP1 - NPWR

POWER	JUMPERS
External Powered	A
NetHub Powered	A and B

JUMPER JP2 - NCOM

POWER	JUMPERS
External Powered	A
NetHub Powered	A and B

TERMINAL BLOCK TB1 – AC POWER

PIN	REFERENCE	WIRE COLOR
1	HOT	BLU
2	EARTH	GRN/YEL
3	NEU	BRN

TERMINAL BLOCK TB2 – NET OUT

TERMINAL BLOCK TB2 – NET IN

PIN	REFERENCE	WIRE COLOR
1	NET PWR	ORG
2	NET+	BLU
3	NET-	WHT/BLU
4	NET COM	WHT/ORG
5	EARTH GND	SHIELD

Note: Cable shield to be clipped off.

TERMINAL BLOCK TB4 – REMOTE

PIN	REFERENCE	WIRE COLOR
1	RMT P1	WHT
2	RMT P2	BRN
3	RMT P3	GRN
4	RMT P4	YEL
5	RMT P5	GRY
6	RMT P6	PNK
7	+12 VDC	BLU
8	+12VDC	RED

TERMINAL BLOCK TB5 – PORT 1

TERMINAL BLOCK TB6 – PORT 2

TERMINAL BLOCK TB7 – PORT 3

TERMINAL BLOCK TB8 – PORT 4

TERMINAL BLOCK TB9 – PORT 5

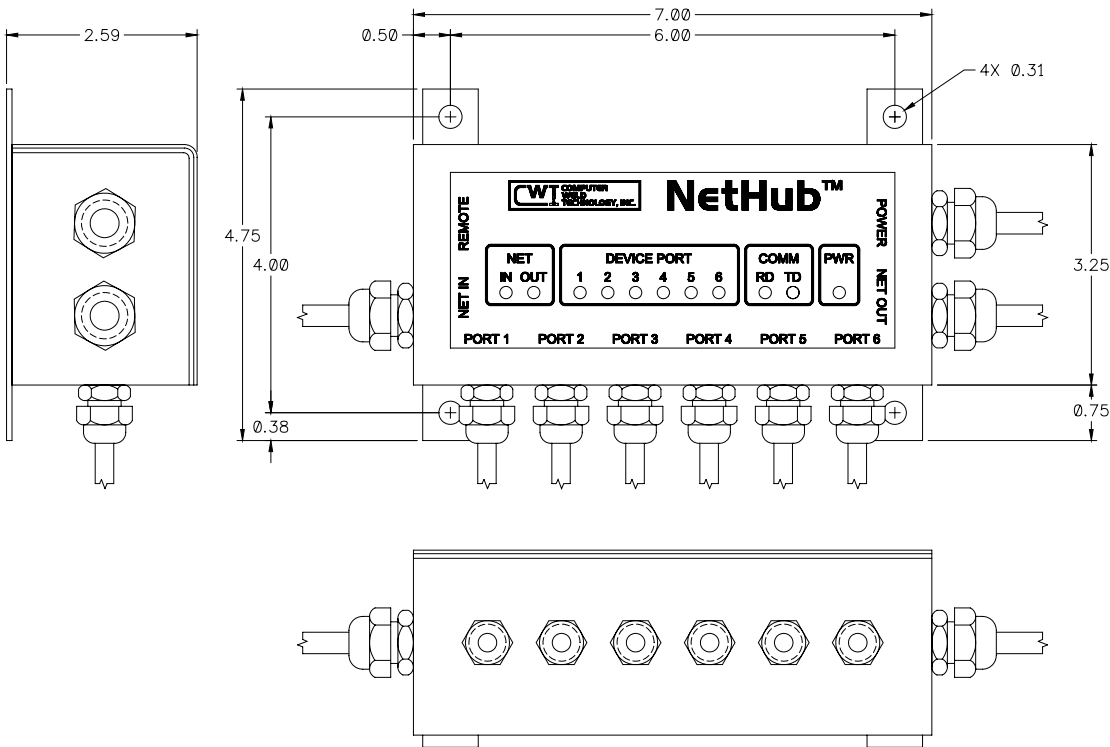
TERMINAL BLOCK TB10 – PORT 6

PIN	REFERENCE	WIRE COLOR
1	+12V	BRN
2	NET+	WHT
3	NET-	BLU
4	REMOTE ON	BLK
5	GND	GRY

Note: Cable shield to be clipped off.

NetHub JUMPER and TERMINAL BLOCK LOCATION DIAGRAM

A.9 NetHub™ Mounting Dimensions



A.10 Communications Cable P/N: A3W0327

This part includes both a cable and a strain relief.
The strain relief is to be used for a NetHub installation.

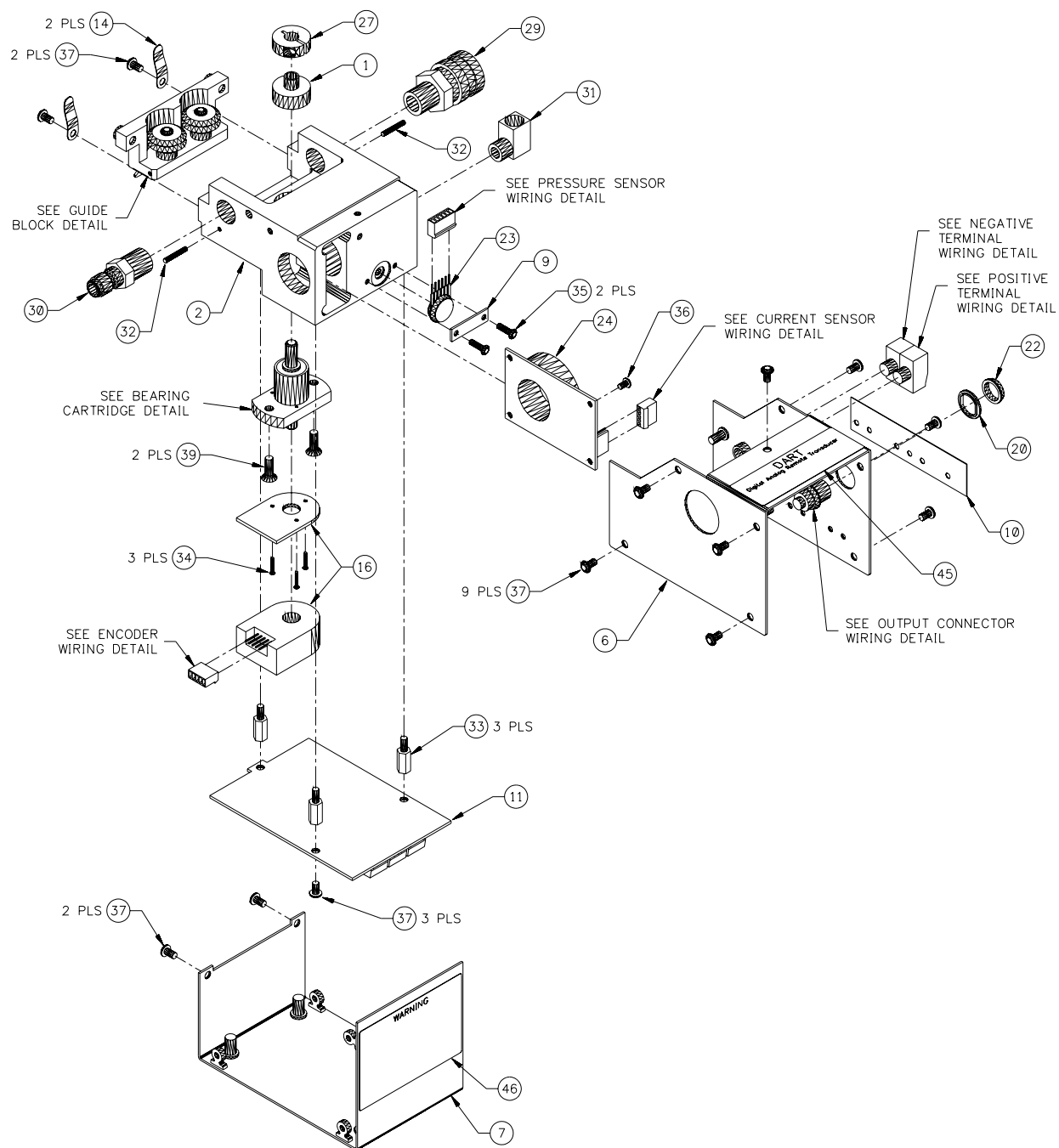
WIRE LIST		
WIRE COLOR	FROM	REFERENCE
BROWN	ITEM 1 PIN 1	+24 VDC
WHITE	ITEM 1 PIN 2	NET+
BLUE	ITEM 1 PIN 3	NET-
BLACK	ITEM 1 PIN 4	REMOTE OND
GRAY	ITEM 1 PIN 5	24VDC GROUND
SHIELD		CABLE SHIELD

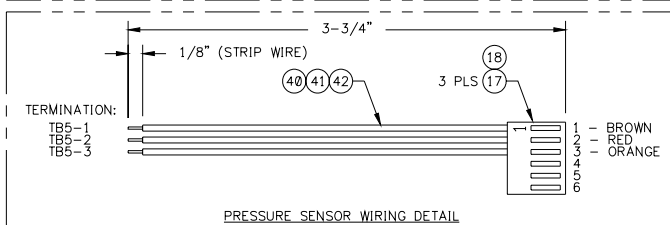
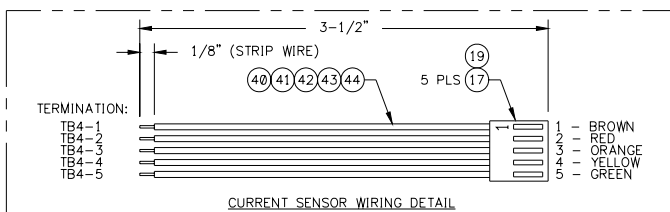
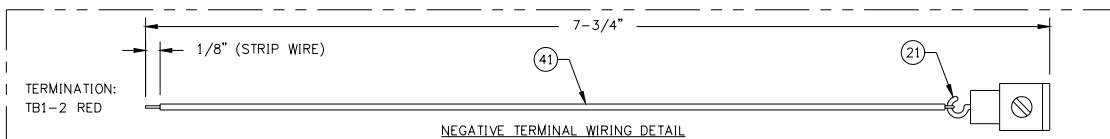
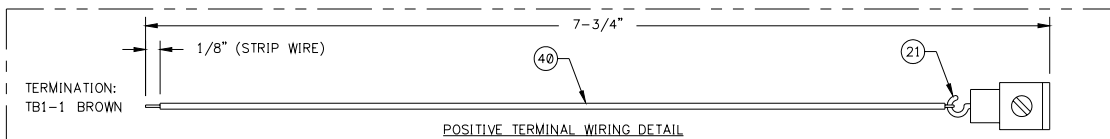
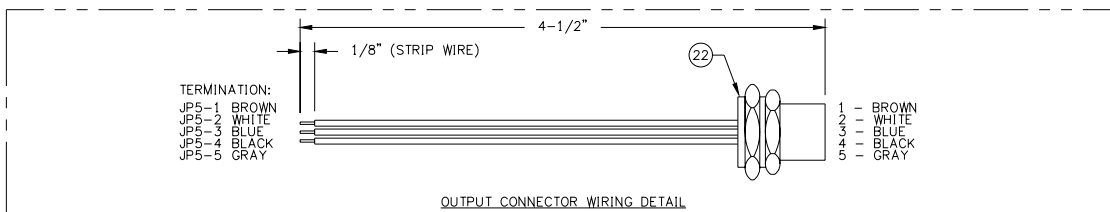
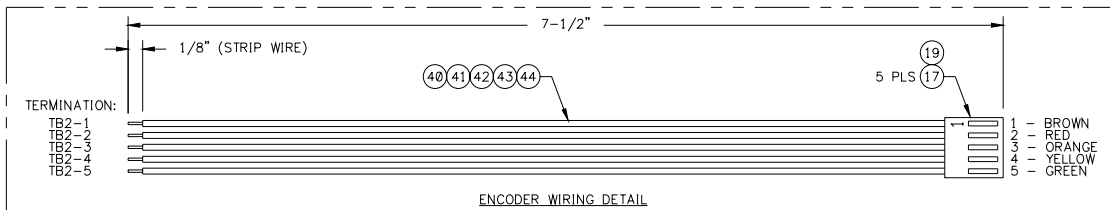
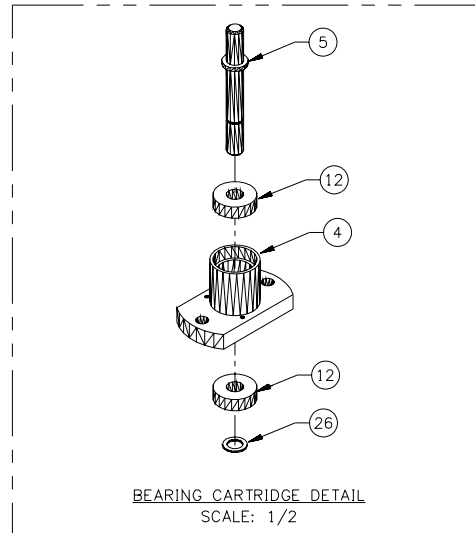
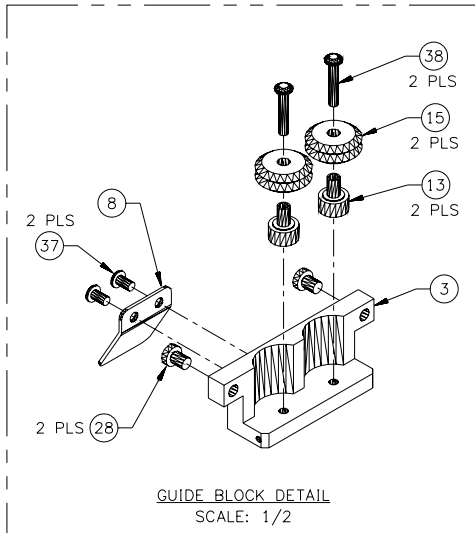


6-Meter Long Cable

Appendix B Intelli-DART™ Sensor Assembly Parts List

B.1 Intelli-DART™ Sensor Assembly P/N: A3A0217 (Rev. 0)

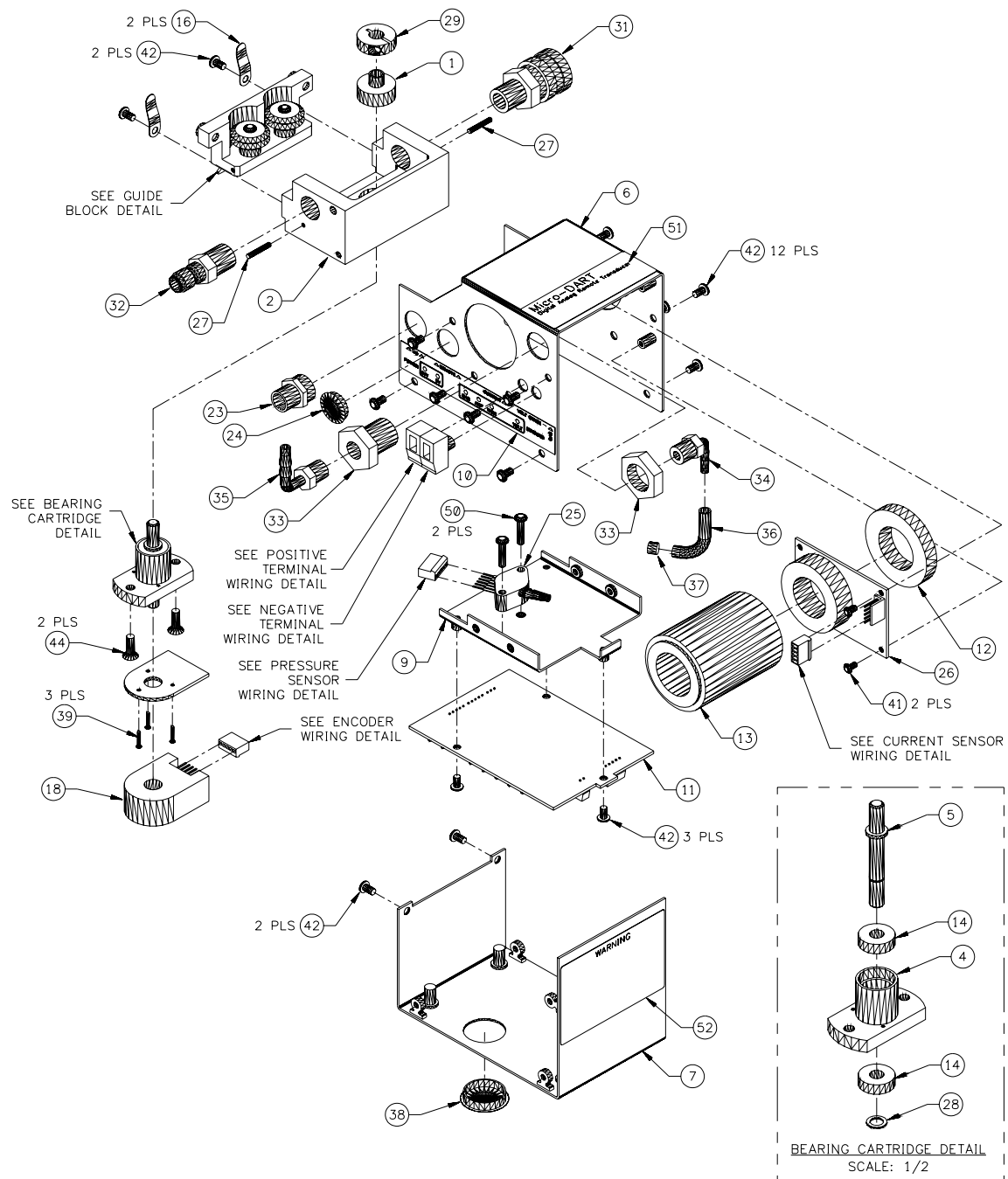


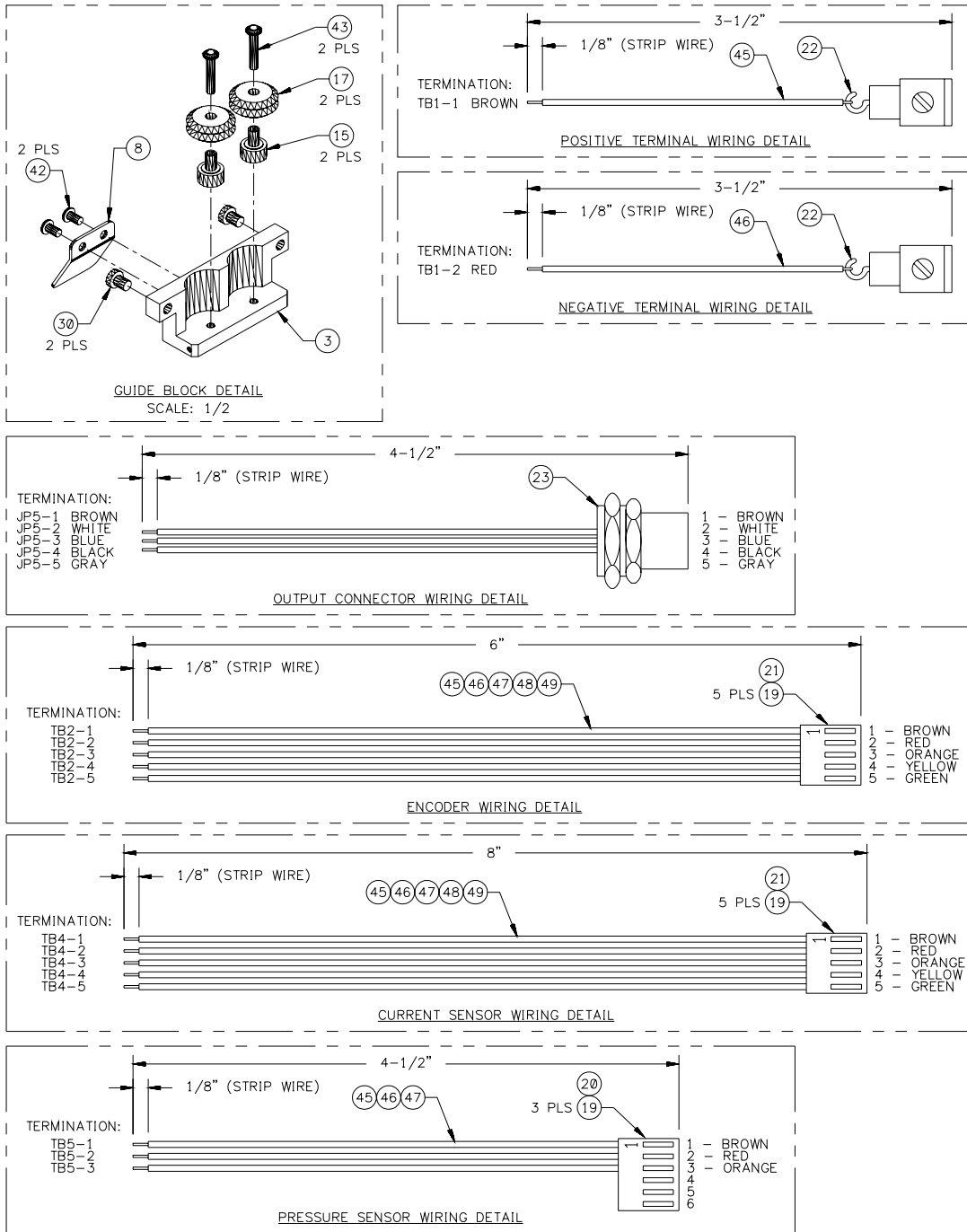


PARTS LIST (Rev. 0)

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	A2A0014	Driven Wheel
2	1	A2M0202	Transducer Block
3	1	A2M0203	Guide Block
4	1	A2M0204	Bearing Cartridge
5	1	A2M0205	WFS Shaft
6	1	A3E0139	Top Cover
7	1	A3E0140	Bottom Cover
8	1	A3E0141	Guide Handle
9	1	A3E0142	Gas Sensor Bracket
10	1	A3E0143	DART Status Overlay
11	1	A5A0109-ID	Intelli-Dart PCB Assembly
12	2	X2B0373	Bearing #R4ZZ MRC
13	2	X2B5002	Stationary Bushing #B-1 Dua-L-Vee
14	2	X2N5023	Flat Spring #U-FS-2 Small Parts
15	2	X2P5004	Wheel #W1-X Dua-L-Vee
16	1	X3M5044	Encoder, Optical 256 cpr #HEDS-5500F06 Agilent
17	13	X3P5138	Crimp, Terminal #08-56-0110 Molex
18	1	X3P5224	Connector, Housing 6 circuit #22-01-2067 Molex
19	2	X3P5443	Connector, Housing 5 circuit #22-01-2057 Molex
20			
21	2	X3P5767	Block, Terminal Series VDFK #0708250 Phoenix
22	1	X3P5805	Connector, RCPT 5 circuit #FS4.5-0.5 Turck
23	1	X3Q5012	Pressure Sensor #MPX5100D Motorola
24	1	X3Q5013	Hall Effect Current Sensor #BB-600 FW Bell
25			
26	1	X6B5025	Retaining Ring, 1/4" External #5100-25 Thruarc
27	1	X6B5054	Shaft Collar #DSCA-5 Small Parts
28	2	X6B5055	Locator Button #CL-1-SLB Carr Lane
29	1	X6F5090	Fitting, Quick Disconnect #BST-2M Parker
30	1	X6F5102	Fitting, Nipple #BST-N2M Parker
31	1	X6F5067	Fitting, Street Elbow 1/8" NPT #BL-2-2-LP Western
32	2	X6P5007	Dowel Pin, 0.093" diameter 3/4" long #D2-6 Berg
33	3	X6S5023	Spacer, M-F 6-32 x 1/2" long #8250 HH Smith
34	3		#0-80 x 3/8" long Philips Pan Head Screw
35	2		#4-40 x 1/2" long Binder Head Screw
36	1		#4-40 x 5/16" long Pan Head Screw w/ Internal Lock Washer
37	18		#6-32 x 5/16" long Pan Head Screw w/ Internal Lock Washer
38	2		#6-32 x 3/4" long Socket Button Head Screw
39	2		#8-32 x 1/2" long Socket Flat Head Screw
40	25"		Wire, 24 AWG CSA Type Tr-64 Brown
41	25"		Wire, 24 AWG CSA Type Tr-64 Red
42	18"		Wire, 24 AWG CSA Type Tr-64 Orange
43	15"		Wire, 24 AWG CSA Type Tr-64 Yellow
44	15"		Wire, 24 AWG CSA Type Tr-64 Green
45	1		Intelli-DART Sensor Serial Number Label
46	1		Warning #1 Label

B.2 Intelli-DART™ Sensor Assembly P/N: A3A0217 (Rev. A)





PARTS LIST (Rev. A)

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	A2A0014	Driven Wheel
2	1	A2M0206	Transducer Block
3	1	A2M0203	Guide Block
4	1	A2M0204	Bearing Cartridge
5	1	A2M0205	WFS Shaft
6	1	A3E0159	Top Cover
7	1	A3E0160	Bottom Cover
8	1	A3E0141	Guide Handle
9	1	A3E0161	PCB Mounting Bracket
10	1	A3E0162	Dart Status Overlay
11	1	A5A0109-ID	Intelli-Dart PCB Assembly
12	1	A2M0207	Small Current Sensor Tube
13	1	A2M0208	Large Current Sensor Tube
14	2	X2B0373	Bearing #R4ZZ MRC
15	2	X2B5002	Stationary Bushing #B-1 Dua-L-Vee
16	2	X2N5023	Flat Spring #U-FS-2 Small Parts
17	2	X2P5004	Wheel #W1-X Dua-L-Vee
18	1	X3M5044	Encoder, Optical 256 cpr #HEDS-5500F06 Agilent
19	13	X3P5138	Crimp, Terminal #08-56-0110 Molex
20	1	X3P5224	Connector, Housing 6 circuit #22-01-2067 Molex
21	2	X3P5443	Connector, Housing 5 circuit #22-01-2057 Molex
22	2	X3P5767	Block, Terminal Series VDFK #0708250 Phoenix
23	1	X3P5805	Connector, RCPT 5 circuit #FS4.5-0.5 Turck
24	1	X6Z5042	Plug, Hole 5/8" Black #2663 Heyco
25	1	X3Q5017	Pressure Sensor #MPX5100DP Motorola
26	1	X3Q5013	Hall Effect Current Sensor #BB-600 FW Bell
27	1	X6B5025	Retaining Ring, 1/4" External #5100-25 Thruarc
28	2	X6P5007	Dowel Pin, 0.093" diameter 3/4" long #D2-6 Berg
29	1	X6B5054	Shaft Collar #DSCA-5 Small Parts
30	2	X6B5055	Locator Button #CL-1-SLB Carr Lane
31	1	X6F5090	Fitting, Quick Disconnect #BST-2M Parker
32	1	X6F5102	Fitting, Nipple #BST-N2M Parker
33	1	X6F5119	Fitting, Coupling Anchor 1/8" NPT #207ACBHS-2 Parker
34	1	X6F5118	Fitting, Elbow 3/16" Hose 1/8" NPT #5013008 New Age
35	1	X6F5115	Fitting, Elbow 1/4" Hose 1/8" NPT #5013043 New Age
36	2.5"	X6H5019	Tubing, Black 0.17" ID 0.25" OD #2121483 New Age
37	1		Clamp, Hose 1/4"
38	1	X6Z5092	Plug, Hole Short 7/8" Black #1699 Heyco
39	3		#0-80 x 3/8" long Philips Pan Head Screw
40	2		#4-40 x 1/2" long Binder Head Screw
41	1		#4-40 x 5/16" long Pan Head Screw w/ Internal Lock Washer
42	21		#6-32 x 5/16" long Pan Head Screw w/ Internal Lock Washer
43	2		#6-32 x 3/4" long Socket Button Head Screw
44	2		#8-32 x 1/2" long Socket Flat Head Screw
45	25"		Wire, 24 AWG CSA Type Tr-64 Brown
46	25"		Wire, 24 AWG CSA Type Tr-64 Red
47	18"		Wire, 24 AWG CSA Type Tr-64 Orange
48	15"		Wire, 24 AWG CSA Type Tr-64 Yellow
49	15"		Wire, 24 AWG CSA Type Tr-64 Green
50	2		#6-32 x 5/8" long Pan Head Screw
51	1		Micro-DART Sensor Serial Number Label
52	1		Warning #1 Label

Appendix C Device ID MSB and LSB Decode Table

Node ID	MSB	LSB	Node ID	MSB	LSB	Node ID	MSB	LSB	Node ID	MSB	LSB
1	0	1	63	3	F	124	7	D	187	B	B
2	0	2	64	4	0	125	7	E	188	B	C
3	0	3	65	4	1	126	7	F	189	B	D
4	0	4	66	4	2	127	8	0	190	B	E
5	0	5	67	4	3	128	8	1	191	B	F
6	0	6	68	4	4	129	8	2	192	C	0
7	0	7	69	4	5	130	8	3	193	C	1
8	0	8	70	4	6	131	8	4	194	C	2
9	0	9	71	4	7	132	8	5	195	C	3
10	0	A	72	4	8	133	8	6	196	C	4
11	0	B	73	4	9	134	8	7	197	C	5
12	0	C	74	4	A	135	8	8	198	C	6
13	0	D	75	4	B	136	8	9	199	C	7
14	0	E	76	4	C	137	8	A	200	C	8
15	0	F	77	4	D	138	8	B	201	C	9
16	1	0	78	4	E	139	8	C	202	C	A
17	1	1	79	4	F	140	8	D	203	C	B
18	1	2	80	5	0	141	8	E	204	C	C
19	1	3	81	5	1	142	8	F	205	C	D
20	1	4	82	5	2	143	9	0	206	C	E
21	1	5	83	5	3	144	9	1	207	C	F
22	1	6	94	5	4	145	9	2	208	D	0
23	1	7	85	5	5	146	9	3	209	D	1
24	1	8	86	5	6	147	9	4	210	D	2
25	1	9	86	5	7	148	9	5	211	D	3
26	1	A	87	5	8	149	9	6	212	D	4
27	1	B	88	5	9	150	9	7	213	D	5
28	1	C	89	5	A	151	9	8	214	D	6
29	1	D	90	5	B	152	9	9	215	D	7
30	1	E	91	5	C	153	9	A	216	D	8
31	1	F	92	5	D	154	9	B	217	D	9
32	2	0	93	5	E	155	9	C	218	D	A
33	2	1	94	5	F	156	9	D	219	D	B
34	2	2	95	6	0	157	9	E	220	D	C
35	2	3	96	6	1	158	9	F	221	D	D
36	2	4	97	6	2	159	A	0	222	D	E
37	2	5	98	6	3	160	A	1	223	D	F
38	2	6	99	6	4	161	A	2	224	E	0
39	2	7	100	6	5	162	A	3	225	E	1
40	2	8	101	6	6	163	A	4	226	E	2
41	2	9	102	6	7	164	A	5	227	E	3
42	2	A	103	6	8	165	A	6	228	E	4
43	2	B	104	6	9	166	A	7	229	E	5
44	2	C	105	6	A	167	A	8	230	E	6
45	2	D	106	6	B	168	A	9	231	E	7
46	2	E	107	6	C	170	A	A	232	E	8
47	2	F	108	6	D	171	A	B	233	E	9
48	3	0	109	6	E	172	A	C	234	E	A
49	3	1	110	6	F	173	A	D	235	E	B
50	3	2	111	7	0	174	A	E	236	E	C
51	3	3	112	7	1	175	A	F	237	E	D
52	3	4	113	7	2	176	B	0	238	E	E
53	3	5	114	7	3	177	B	1	239	E	F
54	3	6	115	7	4	178	B	2	240	F	0
55	3	7	116	7	5	179	B	3	241	F	1
56	3	8	117	7	6	180	B	4	242	F	2
57	3	9	118	7	7	181	B	5	243	F	3
58	3	A	119	7	8	182	B	6	244	F	4
59	3	B	120	7	9	183	B	7	245	F	5
60	3	C	121	7	A	184	B	8	246	F	6
61	3	D	122	7	B	185	B	9	247	F	7
62	3	E	123	7	C	186	B	A			