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# DART™

## Digital Analog Remote Transducer

### Operation / Installation Manual

Manual Part Number: A8M5015  
Revised: 9/28/2004





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## 1.0 SYSTEM OVERVIEW

### 1.1 General Overview

The DART™ Sensor (A3A0207) is a lightweight, compact, multi-sensor unit designed for monitoring of the GMAW welding process. The DART™ Transducer provides the necessary isolation and signal conditioning for remote weld data acquisition sub systems. The DART™ converts the arc voltage, current and torch shielding gas pressure to an isolated 0-10 vdc output and the wire feed speed to a TTL level of 100 pulse/inch output.

The light weight, easy to install design allows the user to install the 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 (X3W5102). This cable also provides the Analog and TTL Signal Outputs to an external system (data acquisition or PLC).

Listed below are the system specifications:

### 1.2 General 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 @ 0.1 amp, ripple 200 mv
Operating Temp:	-10 ° F to +140° F ( -12°C to +60°C)
Analog Output:	0 -10 vdc @10ma current limited
Encoder Output:	TTL compatible levels sink/source 25ma

### 1.3 Sensor Specifications

#### Current Sensor:

Range	0 – 600 Amps (DC)
Precision of Range	± 1%
Max Linearity Error	± 0.9 % of reading
Max Zero Offset Error	± 3.0 mv
Sensitivity (V out / V in)	10 mv / AMP
Band Width at ±1 db	2.5 KHz

#### Voltage Sensor:

Range	0 – 100 volts (DC)
Precision of Range	± 1%
Max Linearity Error	± 0.5 % of reading
Max Zero Offset Error	± 1.0 mv
Sensitivity (V out / V in)	± 1.0 mv
Band Width at ±1 db	2.5 KHz

#### Gas Pressure Sensor:

Pressure Range	2.18 – 14.5 Psi (15 – 100 Kpa)
Precision of Range	± 3%
Max Linearity Error	± 1.8 % of reading
Max Zero Offset Error	± 0.510 Vdc
Sensitivity (V out / V in)	0.5 Vdc / Psi
Band Width at ±1 db	250 Hz

#### Wire Speed Sensor:

Wire Diameter Range	0.30 – 0.62 (0.8 mm – 1.6 mm)
Speed Range	10 – 1000 ipm (4 – 420 mm/s)
Precision of Range	± 3%
Encoder Pulse Rate	100 pulse / inch (3.94 pulses / mm)
Output Freq Range	16.7 – 1666.7 Hz

## 2.0 INSTALLATION

### 2.1 General Guidelines

The 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 DART™:

- Mount the 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 DART™ be mounted as close to the wire feeder as possible (**not to exceed 36"**).
- The Positive welding cable must pass through the 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 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 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 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 DART™ is a simple 5-step process regardless of the selected mounting method.

1. Feed the Positive welding cable through the 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 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 36") for support of the wire from the DART™ to the wire feeder inlet.
3. Connect the Shielding Gas line to the 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 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 DART™ Sensor to connect the 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 (X3W5102) to the DART™, insert the connector into the 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 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.



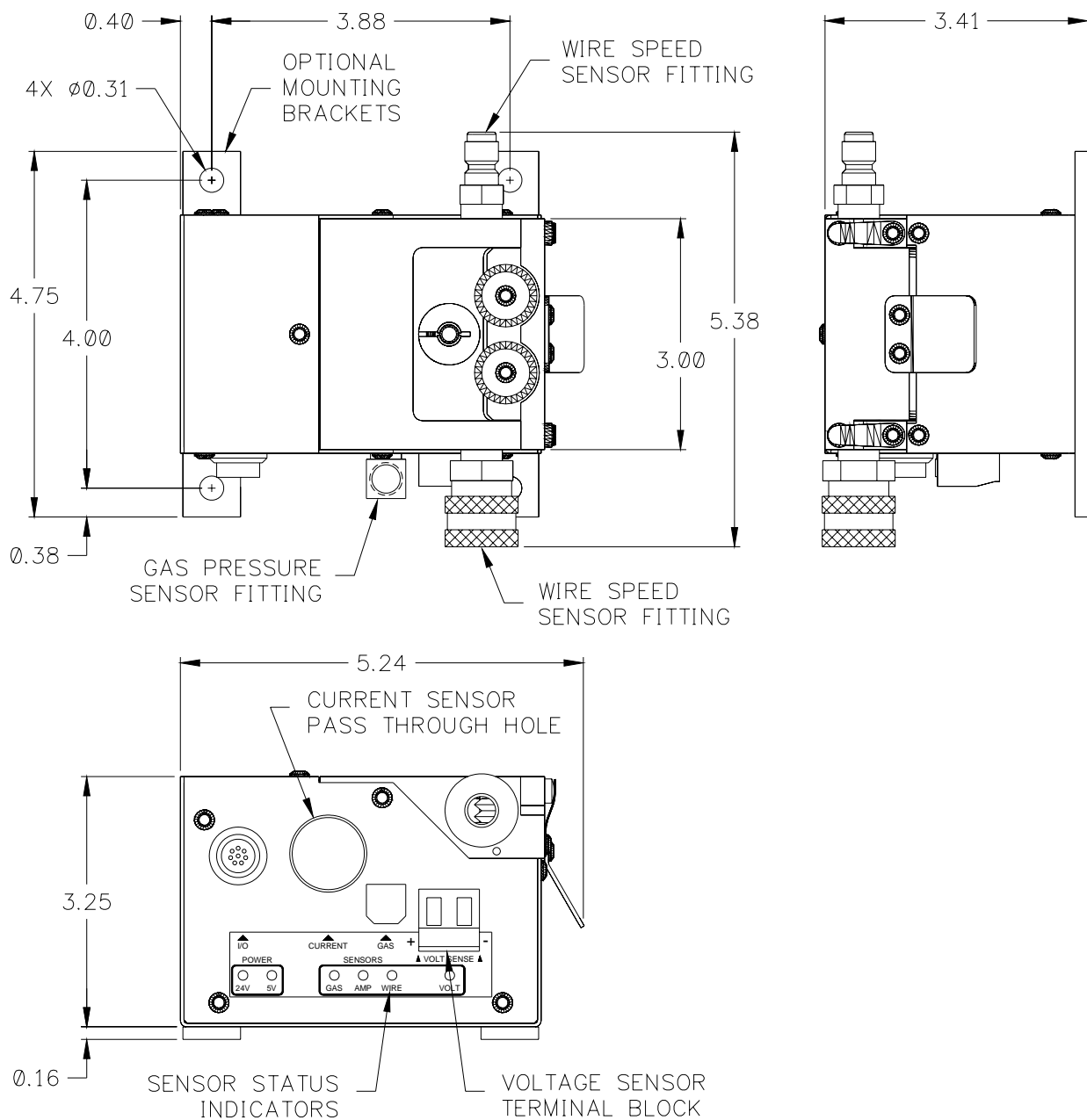
### 3.0 OPERATIONS

The DART™ is designed to provide an analog output for each parameter that it is connected to. Review the following chart for an explanation of actual parameter reading vs. expected analog reference out from the sensor.

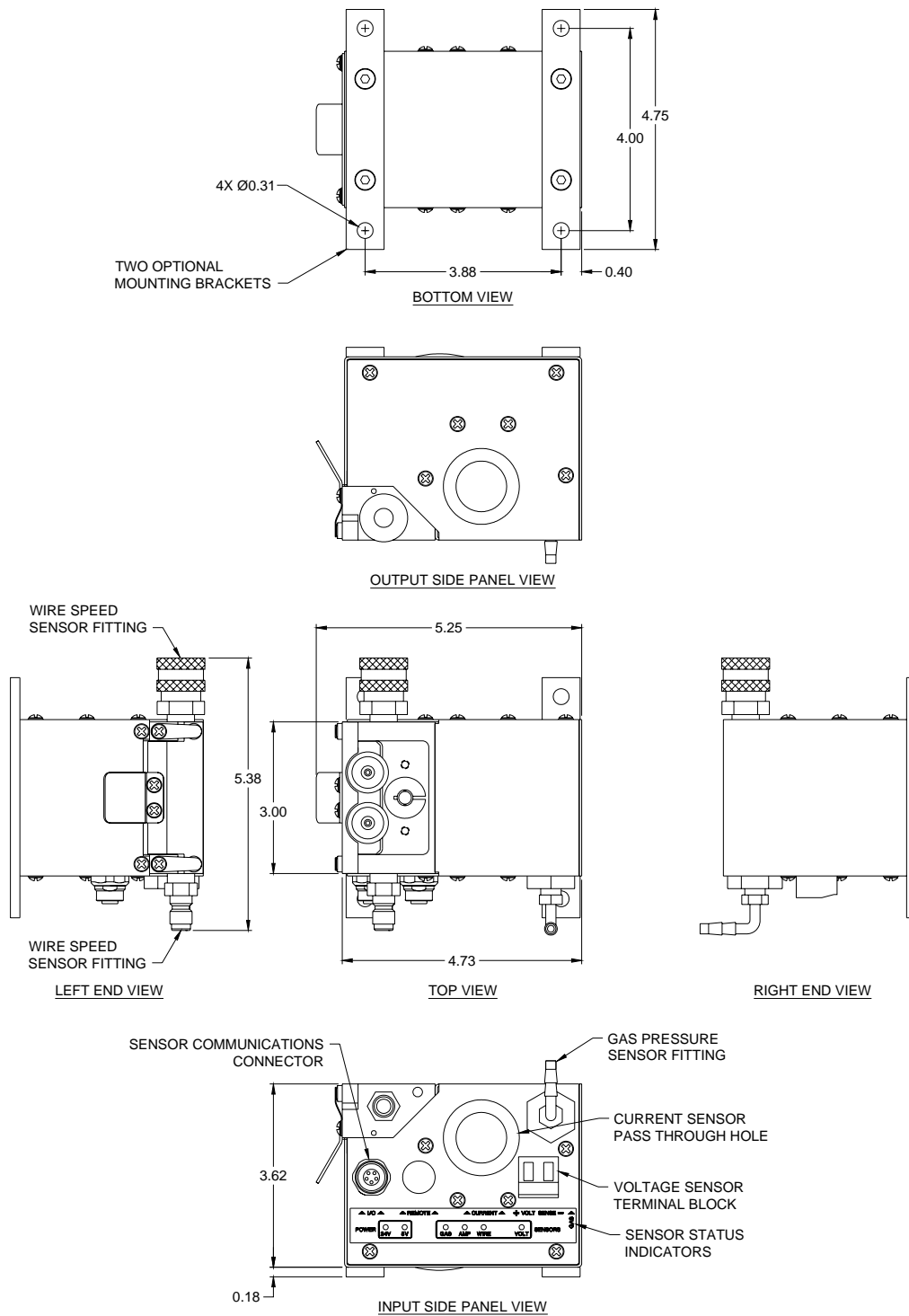
PARAMETER	ACTUAL VALUE	EXPECTED ANALOG VALUE OUT
Volts	20.0 VOLTS	2.0 VOLTS ANALOG VALUE OUT ( 1 Volt In = 10mv Out )
Amps	100 AMPS	VOLTS ANALOG VALUE OUT ( 1 Amp In = 10 mv Out )
Gas Pressure	5 PSI 10 PSI	2.5 VOLTS ANALOG VALUE OUT 5.0 VOLTS ANALOG VALUE OUT 1 PSI = 0.5 Vdc Out )
Wire Feed Speed	Produces 102 pulses per Linear inch of wire	

## Appendix A DART™ Installation Specifications

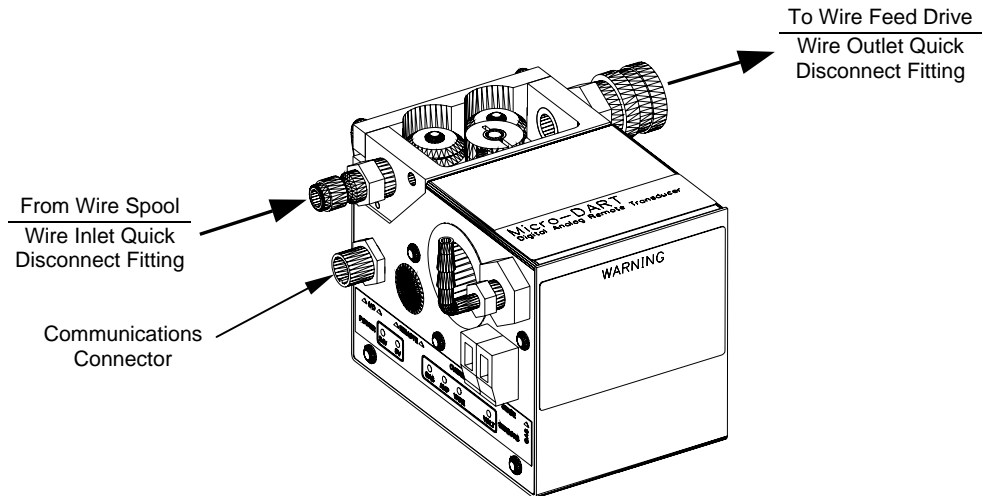
### A.1 DART™ Sensor (Rev. 0 and Rev. A) Mounting Dimensions



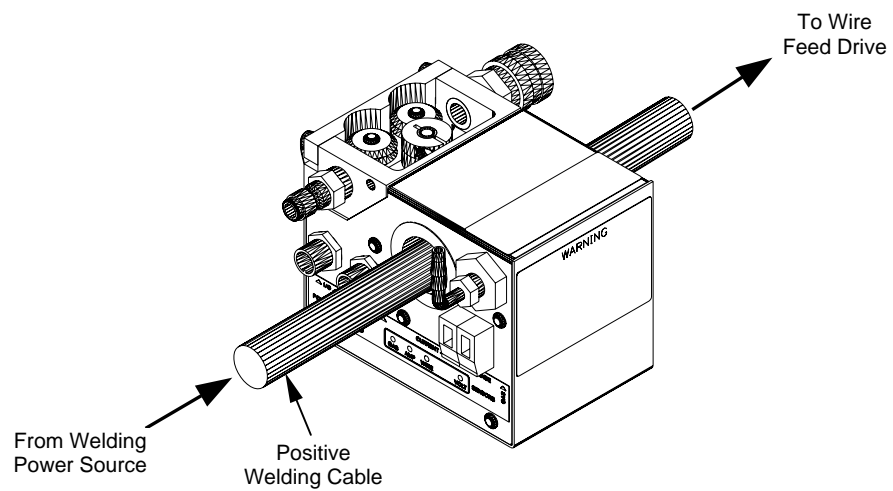
## A.2 DART™ Sensor (Rev. B) Mounting Dimensions



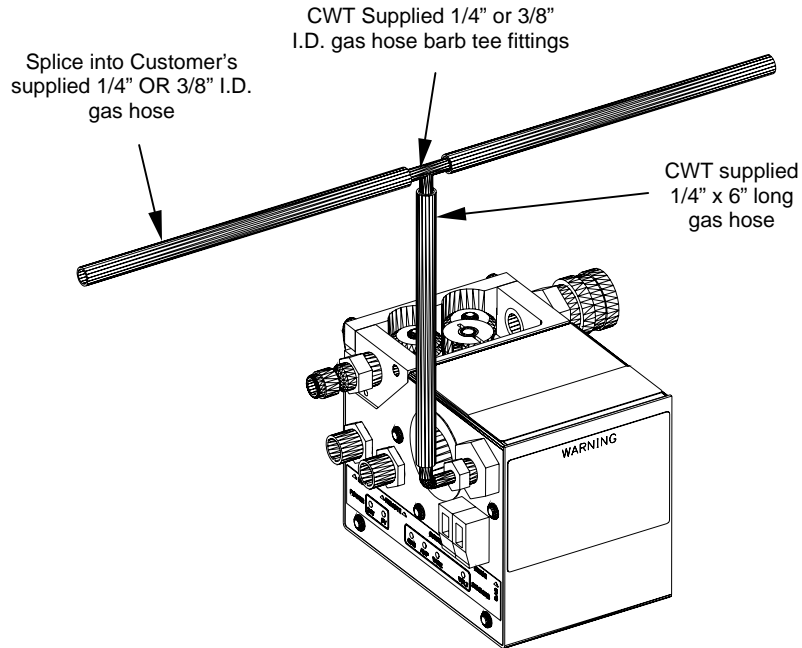
### A.3 Sensor Cable and Wire Speed Sensor Installation



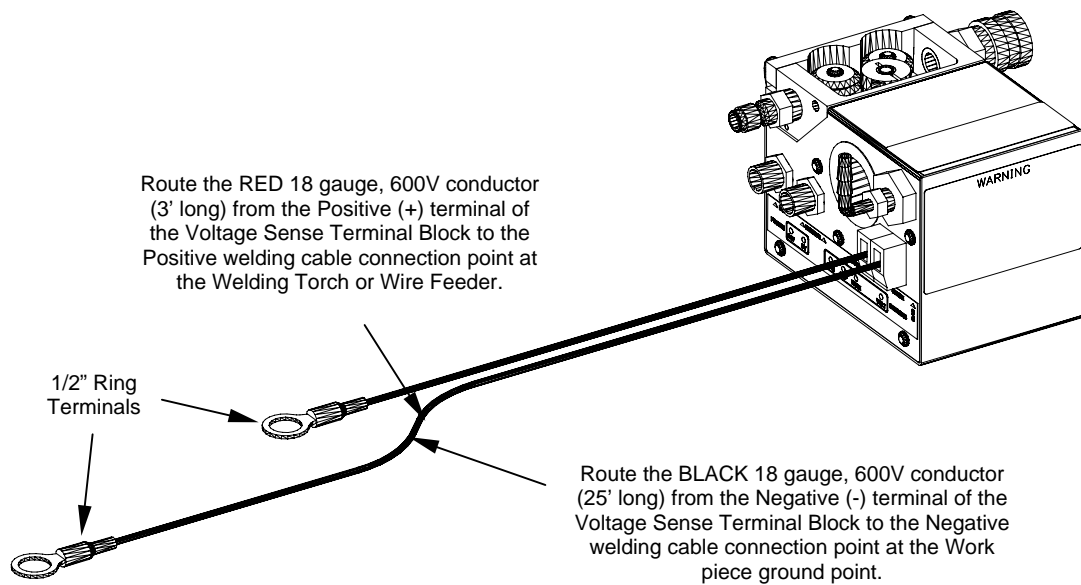
### A.4 Positive Welding Cable Installation



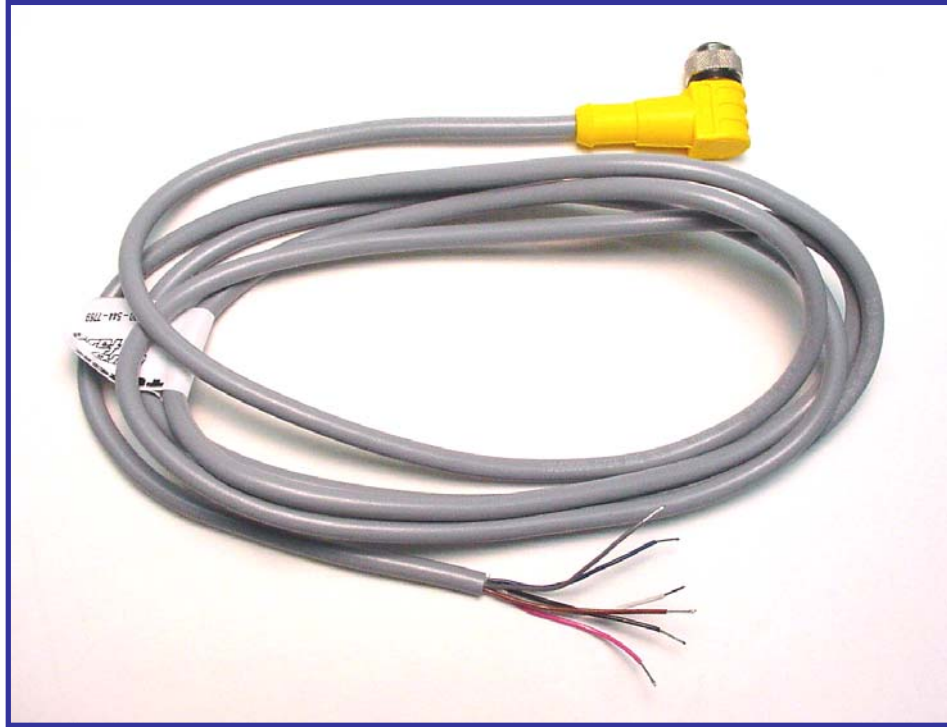
## A.5 Gas Pressure Hose Installation



## A.6 Voltage Sensor Installation



## Appendix B     DART™ Sensor Cable P/N: X3W5102



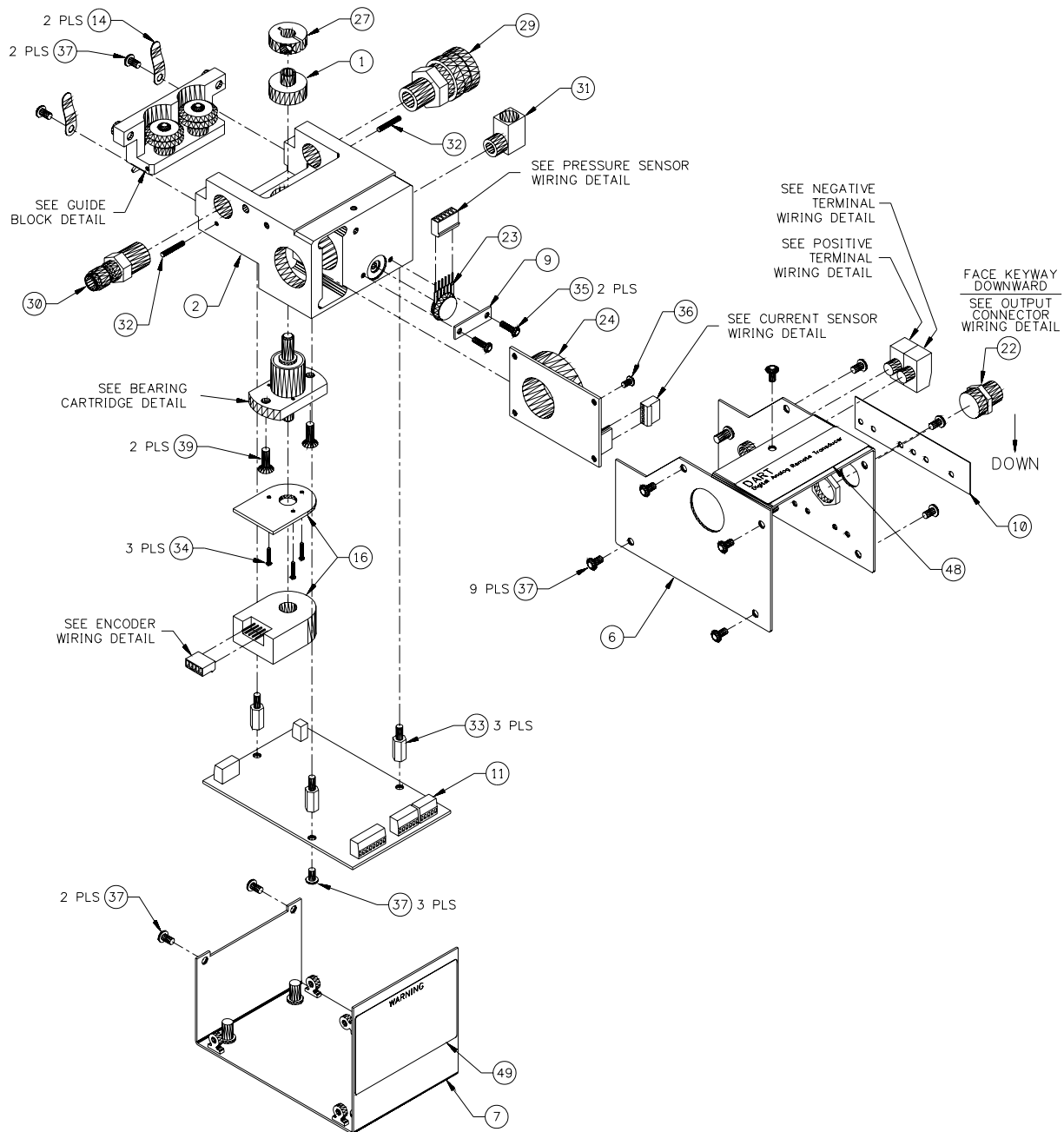
**6 Meter Long Cable**

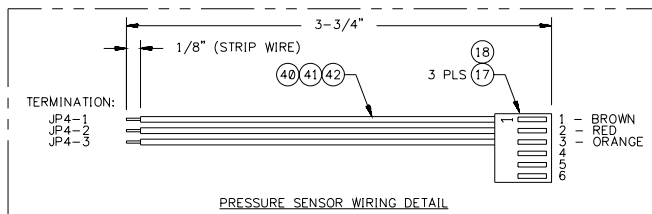
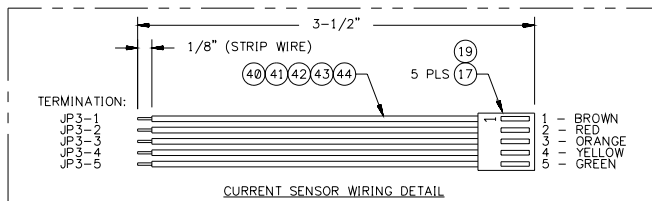
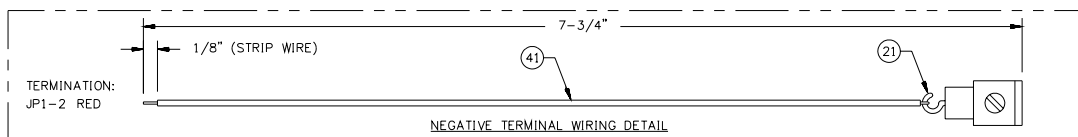
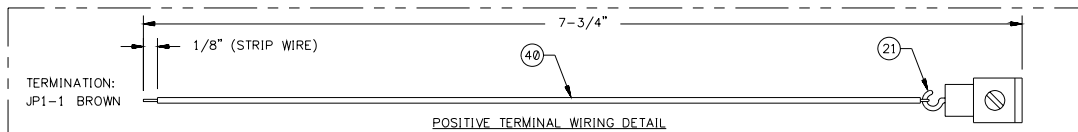
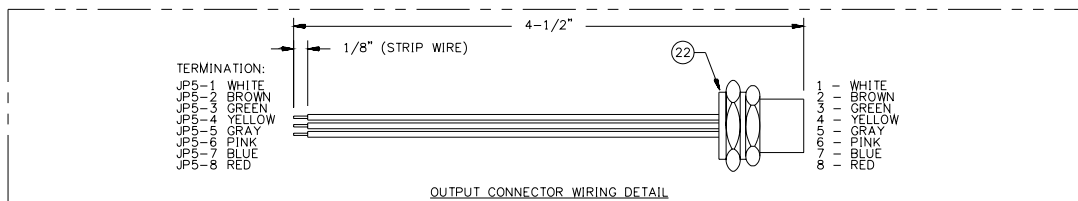
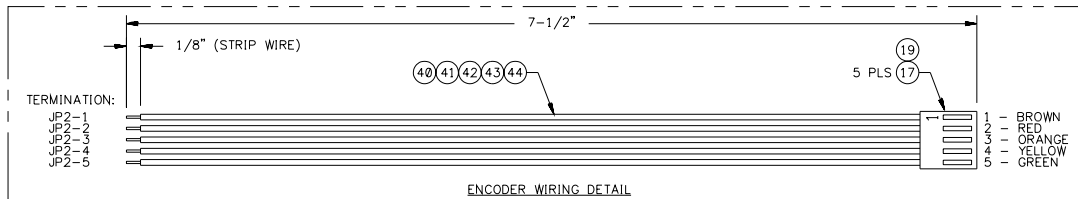
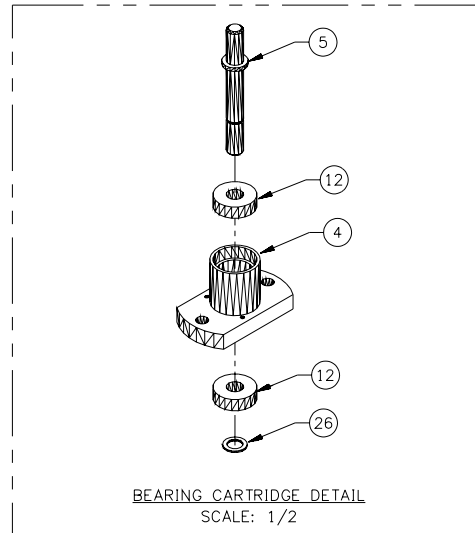
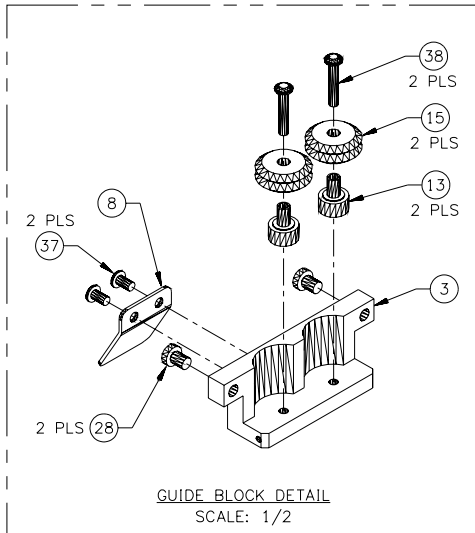
### WIRE LIST

WIRE COLOR	FROM	WIRE LABEL	REFERENCE
WHITE	ITEM 1 PIN 1	+24VDC	+24 VDC
BROWN	ITEM 1 PIN 2	COM	COM
GREEN	ITEM 1 PIN 3	VOLT+	VOLT + (0 – 10 VDC ANALOG OUT)
YELLOW	ITEM 1 PIN 4	AGND	ANALOG GROUND
GRAY	ITEM 1 PIN 5	AMP+	AMP + (0 – 10 VDC ANALOG OUT)
PINK	ITEM 1 PIN 6	GPSIA	GAS PSI + (0 – 10 VDC ANALOG OUT)
BLUE	ITEM 1 PIN 7	WFS	WIRE FEED SPEED (TTL)
RED	ITEM 1 PIN 8	DGND	WIRE FEED SPEED DIGITAL GROUND

## Appendix C DART™ Sensor Assembly Part List

### C.1 DART™ Sensor Assembly P/N: A3A0207 (Rev. 0 and Rev. A)



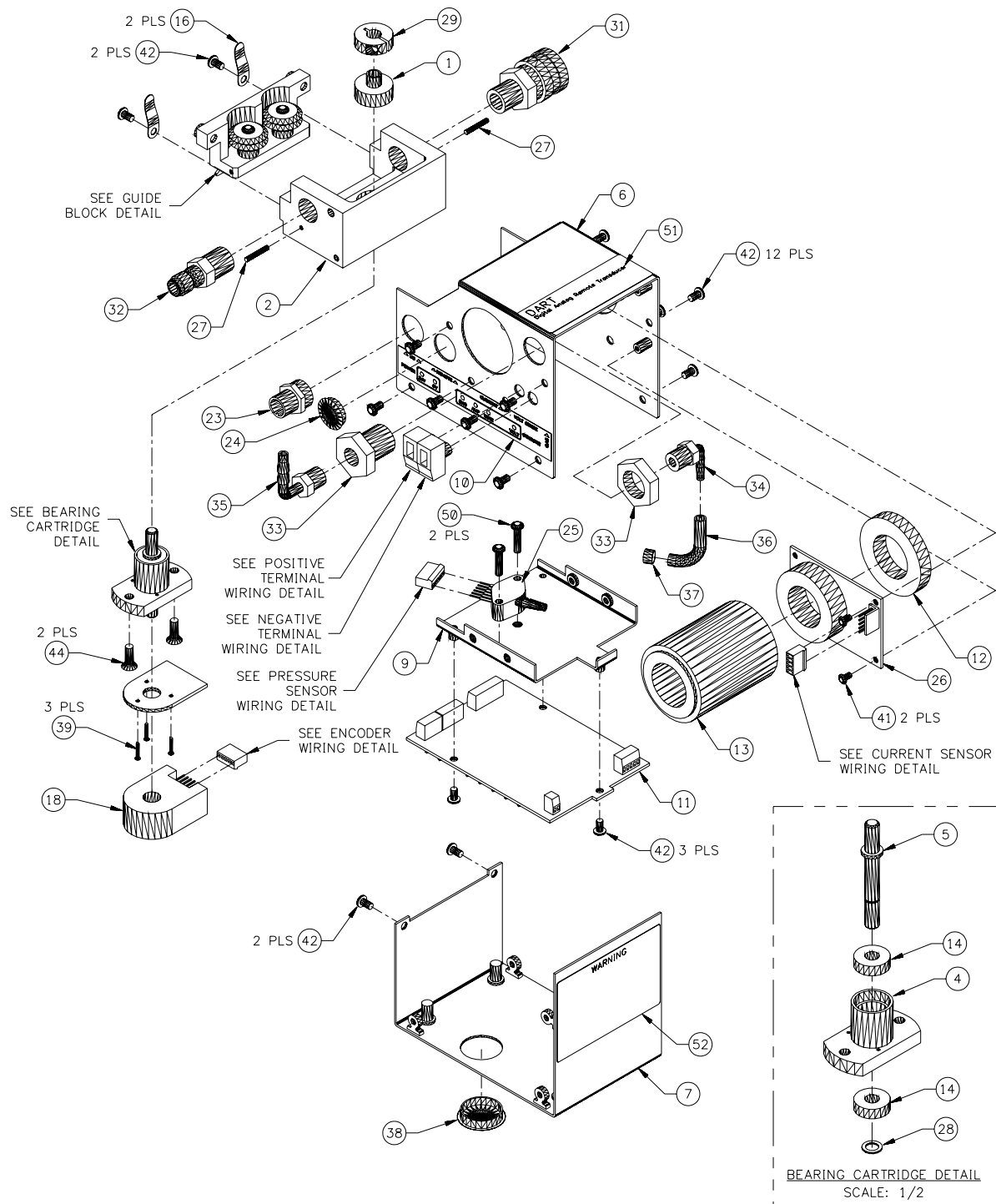


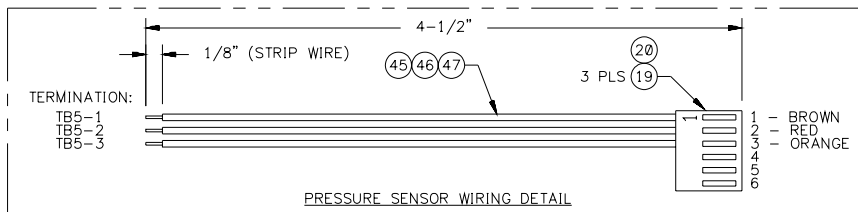
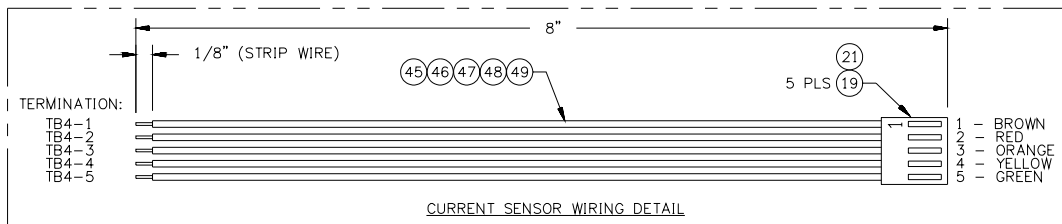
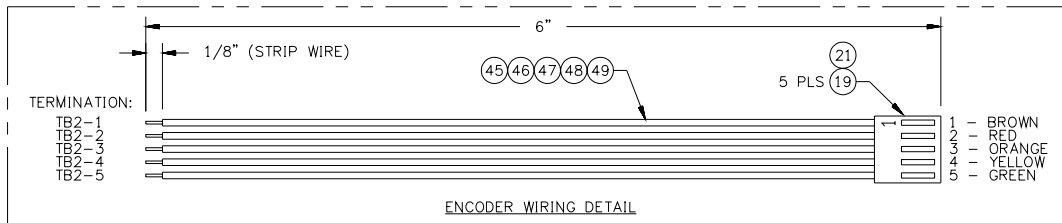
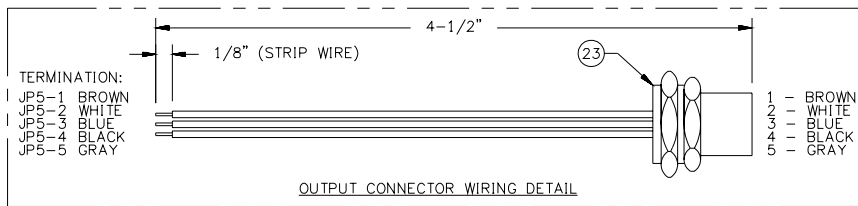
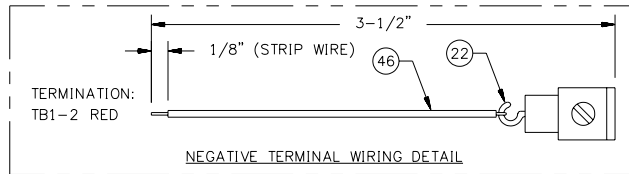
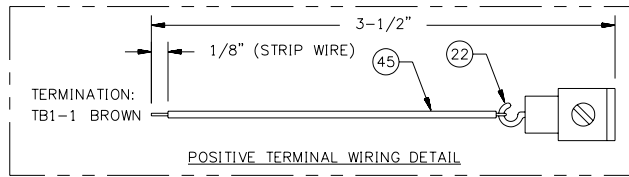
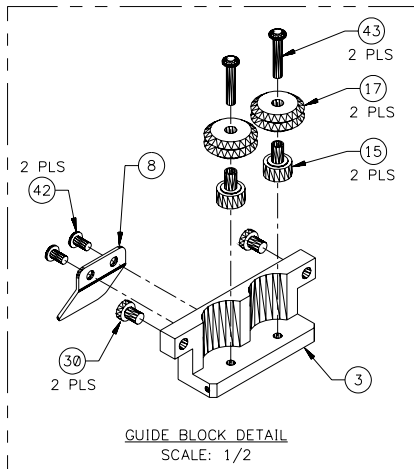


**PARTS LIST (Rev. 0 and Rev. A)**

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	A5A0107	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	X3P5807	Connector, RCPT 8 circuit #FS8-0.5 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	4"		Wire, 24 AWG CSA Type Tr-64 Blue
46	4"		Wire, 24 AWG CSA Type Tr-64 Violet
47	4"		Wire, 24 AWG CSA Type Tr-64 White
48	1		DART Sensor Serial Number Label
49	1		Warning #1 Label

## C.2 DART™ Sensor Assembly P/N: A3A0207 (Rev. B)





**PARTS LIST (Rev. B)**

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	A5A0107	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	X3P5807	Connector, RCPT 8 circuit #FS8-0.5 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		DART Sensor Serial Number Label
52	1		Warning #1 Label