Document Number:
XE-XXREF001-R0A

GENERAL REFERENCE INFORMATION

FIRE RESEARCH CORPORATION
www.fireresearch.com
26 Southern Blvd., Nesconset, NY11767
TEL (631) 724-8888 FAX (631) 360-9727 ***TOLL FREE 1-800-645-0074***

CONTENTS

Table of Contents

List of Tables

List of Figures

TROUBLESHOOTING GUIDE

This is a general guide and some of the tips may not apply to all FRC products. When troubleshooting refering to the product manual operation, calibration, and wiring sections may be needed as a reference.

Check the wiring against the wiring documentation for assembly and installation type errors.

Look for opens across terminal strips or splice connections; bad pin crimps or connector fabrication problems; wires connected to the wrong point.

This is easiest done visually and with a continuity checker or ohm meter.

Note: When checking for continuity ensure all power is off and battery connections are isolated from wiring being checked.

Check for +12 VDC power (red wire) and ground (black wire) to the FRC control module supply power input.

Power should be supplied when the ignition is on.

Check for +12 VDC on the interlock input (white wire) to the FRC module.

The safety interlock ensures that certain safety conditions are met before a remote engine controller is allowed to take control of the engine. These may include relays, switches, and/or indicator lights for some of these conditions; parking brake on; PTO engaged; transmission in drive/neutral/park; high idle; ok to pump; throttle ready.

Check that specific ECM programming has been set to allow for remote engine control.

This may require a dealer service tool and programming information.

Check that ECM conditions for remote engine control have been met.

This may include supplying +12 VDC or ground to specific pins on the ECM that are not wired to the FRC control module.

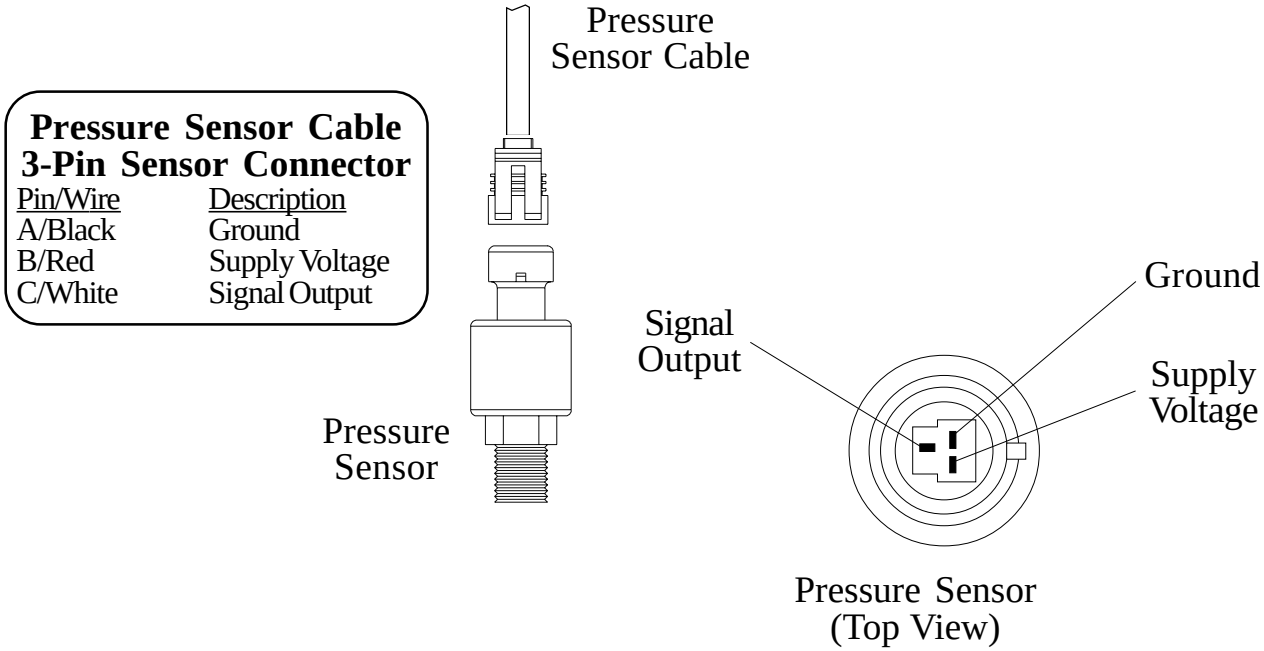
FRC PRODUCT CONNECTOR PINOUTS

Pressure Sensors

The wires used in a basic cable that FRC provides to connect the control module to a pressure sensor may use different connectors depending on the specific application. The sensors have an excitation voltage of 5 VDC that is supplied from the control module.

Basic Control Module Pressure Sensor Connector Wiring

Wire Color	Description
Black	Ground
Red	+5 VDC Supply
White	Signal to Control Module
Yellow	Shield (only on extension cables)



Signal Output in DC Volts

PSI	0	100	150	200	250	300	600
Sensor Type							
XE-PR031PT2	0.5	1.917	2.625	3.33	4.04	4.75	N/A
XE-FP3100PT2	0.5	1.21	1.56	1.92	2.27	2.625	4.75
XE-FP4000PT1	0.5	1.21	1.56	1.92	2.27	2.625	4.75
XE-IO3100PT2	0.604	1.295	1.640	1.985	2.331	2.677	4.85

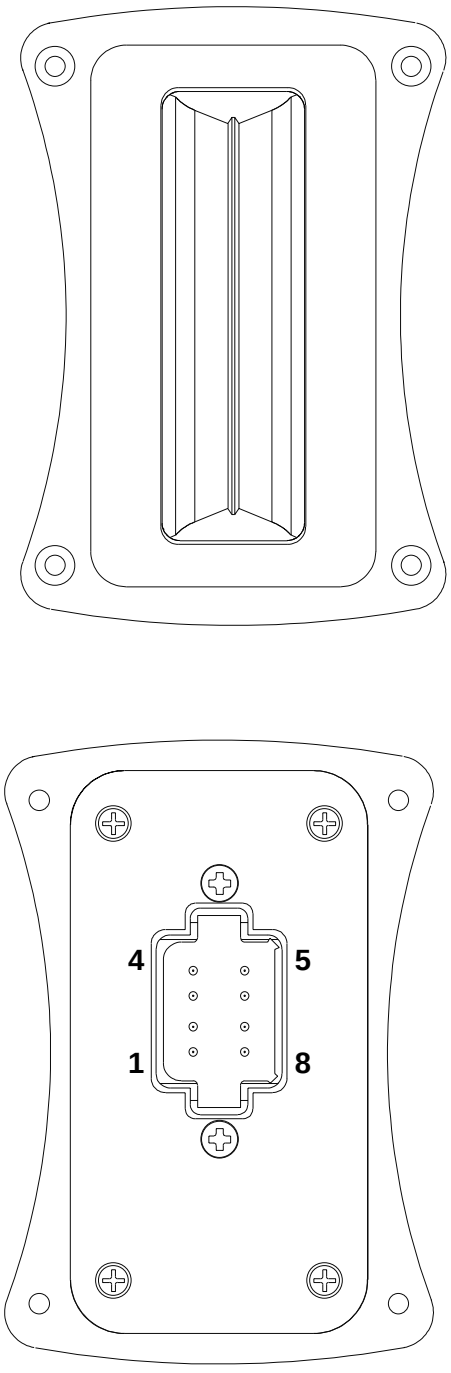
Note: See Tank Indicator for tank pressure sensor.

Figure 1. Pressure Sensors

TankVision

Tank Indicator

The **TANKVISION** indicator shows the **actual volume** of liquid in a tank. The liquid in the tank exerts a pressure that is measured by a sensor. As the amount of liquid changes, the pressure it exerts on the sensor changes proportionally. The pressure change is used to calculate the exact volume of liquid in the tank. The **TANKVISION** can be calibration to accurately display the volume of liquid in tanks of all shapes and sizes.



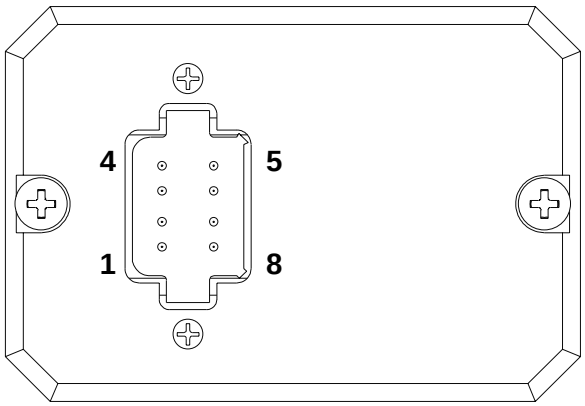
Primary Display Connector

Pin	Description
1	Power 9-30 VDC
2	Ground
3	Sensor 5 VDC
4	Sensor Signal
5*	Buzzer Ground (150mA)
6	Display Signal Out
7	Datalink (+)
8	Datalink (–)

Remote Display Connector

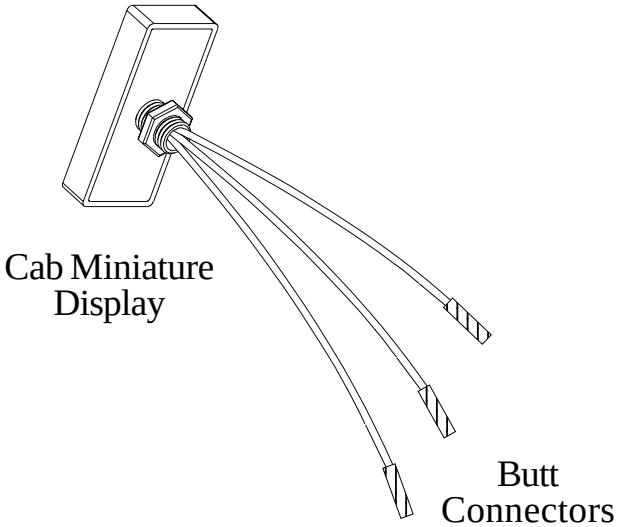
Pin	Description
1	Power 9-30 VDC
2	Ground
3	N/A
4	N/A
5	Buzzer Ground (150mA)
6	Display Signal Out
7	Datalink (+)
8	Datalink (–)

Figure 2. Tank Indicator



Light Driver Connector

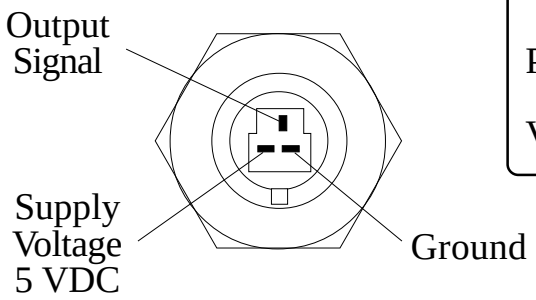
Pin	Signal Description
1	Ground
2	Signal Input
3*	Remote Light Power
4	1/4 Tank Output
5	1/2 Tank Output
6	3/4 Tank Output
7	Full Tank Output
8*	Remote Light Power



Cab Miniature Display Wiring

Wire	Description
Red	Power 9-30 VDC
Black	Ground
White	Display Signal

Pressure Sensor Connector



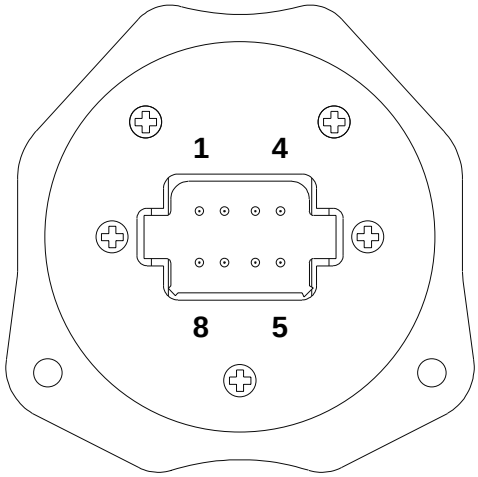
TankVision Pressure Sensor (P/N XE-WLPT1)
Output Signal Voltages

PSI	0	1	2	3	4	5
VDC	0.5	1.3	2.	2.9	3.7	4.5

Insight

Digital Flowmeter

The **INSIGHT** digital flowmeter has a 4-digit LED flow display with daylight bright digits 0.56 inch high. The flowmeter is able to communicate with other display modules over the FRC datalink. This technology allows for remote displays, the display of flow for multiple discharges (summing), and the totalization of flow for multiple discharges (accumulation).



DFA400 Connector

Pin	Signal Description
1	Power 9 - 30 VDC
2	Ground
3	Flow Sensor 5 VDC
4	Flow Sensor Ground
5	Flow Sensor Signal
6	N/C
7	FRC Datalink Low
8	FRC Datalink High

Flow Sensor output signal will be a +5 volt TTL pulse that varies with the speed of the spinning paddle.

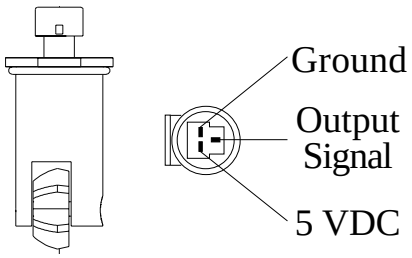
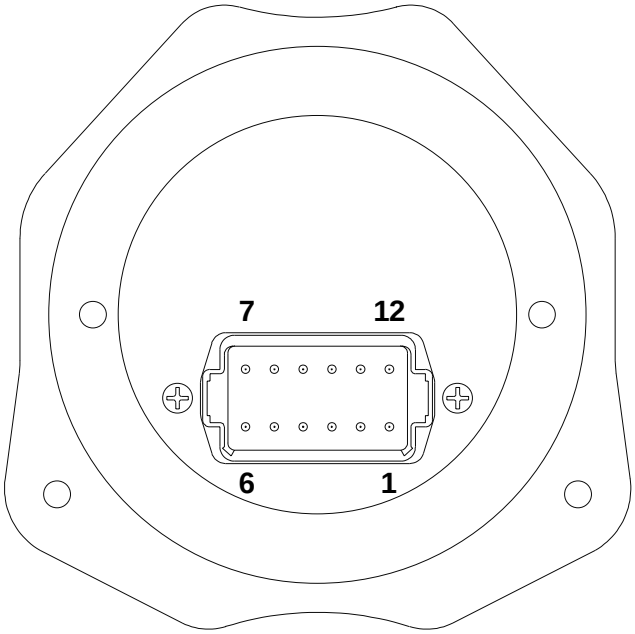


Figure 3. Digital Flowmeter

Insight Ultimate

Digital Flowmeter and Pressure Indicator

The **INSIGHT ULTIMATE** digital flowmeter and pressure indicator combines a digital LED flow display and a traditional style electronic pressure indicator into one practical display module. The flowmeter/pressure indicator is able to communicate with other display modules over the FRC datalink. This technology allows for remote displays, the display of flow for multiple discharges (summing), and the totalization of flow for multiple discharges (accumulation).



FPA400 Connector

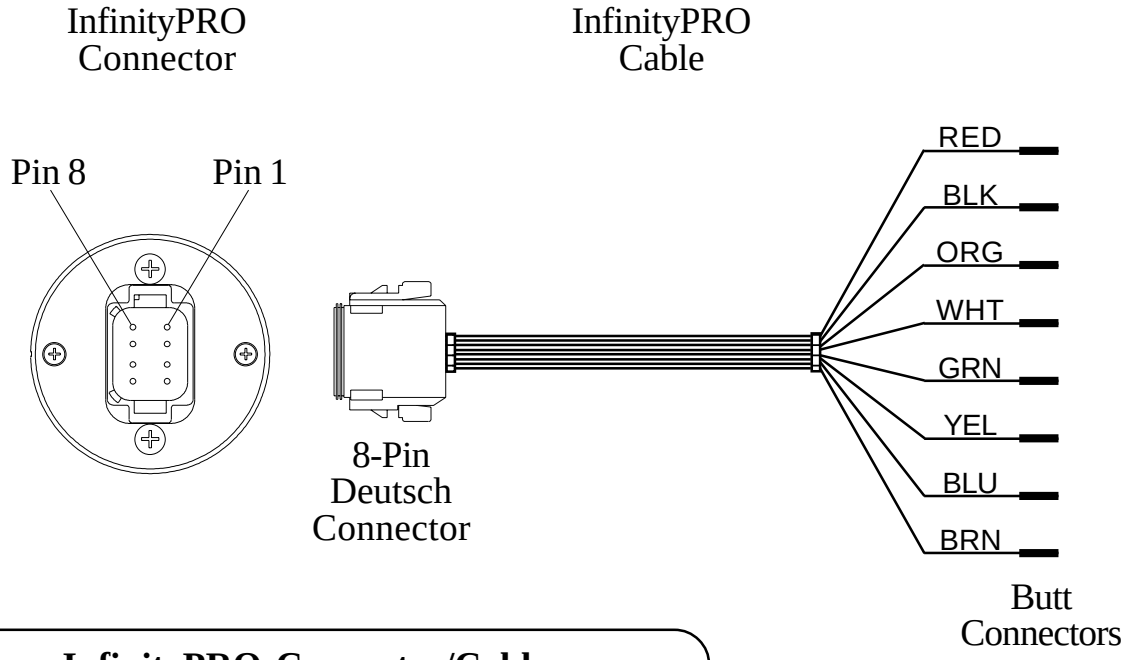
Pin	Signal Description
1	Power 9 - 30 VDC
2	Ground
3	Flow Sensor 5 VDC
4	Flow Sensor Ground
5	Flow Sensor Signal
6	Pressure Sensor 5 VDC
7	Pressure Sensor Ground
8	Pressure Sensor Signal
9	NC
10	External Totalizer Button
11	Datalink CAN Low
12	Datalink CAN High

Figure 4. Digital Flowmeter and Pressure Indicator

Infinity PRO

Remote Engine Throttle

The **infinityPRO** series of remote engine throttles use optical technology. There is no potentiometer, electromechanical switch, or mechanical stop. The engine RPM control signal will be set at idle when power is applied regardless of the control knob position.



InfinityPRO Connector/Cable

Pin	Wire Color	Description
1	Red	Supply Voltage (9 - 30 VDC)
2	Black	Ground
3	Orange	+5 VDC Reference From ECM
4	White	Throttle Signal To ECM
5	Green	Signal Return From ECM
6	Yellow	Interlock Input (12 or 24 VDC)
7	Blue	Throttle Enable Signal (or IVS)
8	Brown	Foot Pedal Signal Input

Note: Not all wires are used for all engines. Refer to the engine specific wiring diagram for InfinityPRO interface connections.

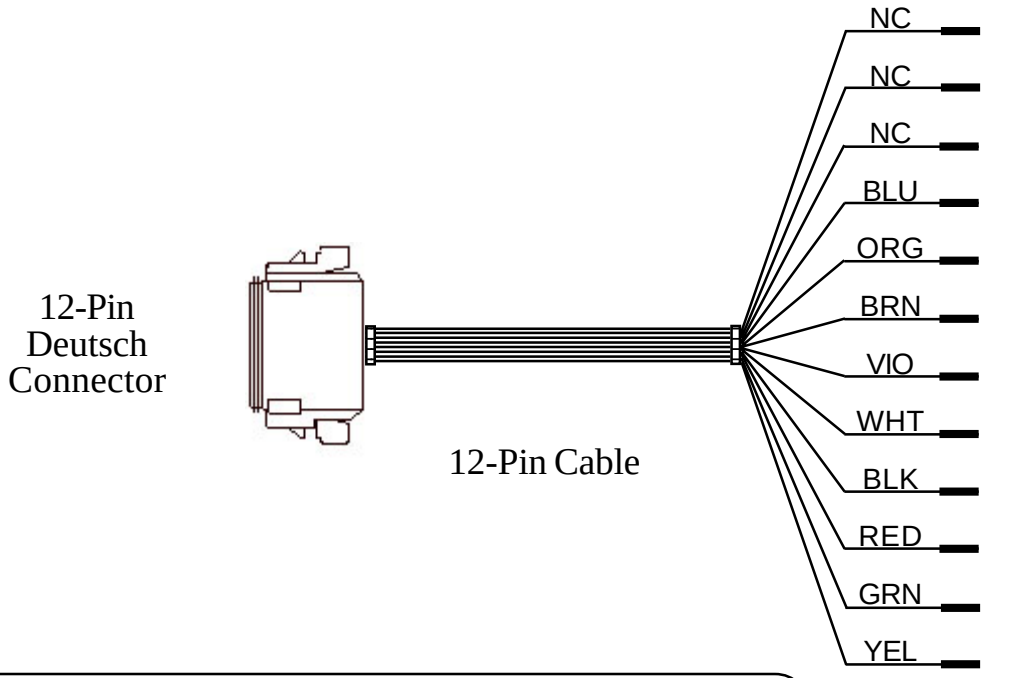
Figure 5. Remote Engine Throttle

This page intentionally left blank.

ThrottleXcel

Remote Engine Throttle and Display

The **ThrottleXcel** is an all-in-one instrument panel that integrates a traditional style remote hand throttle with engine monitoring and display. It offers complete remote display and engine control (as a remote throttle, the **ThrottleXcel** is not an engine governor) in a single compact unit.

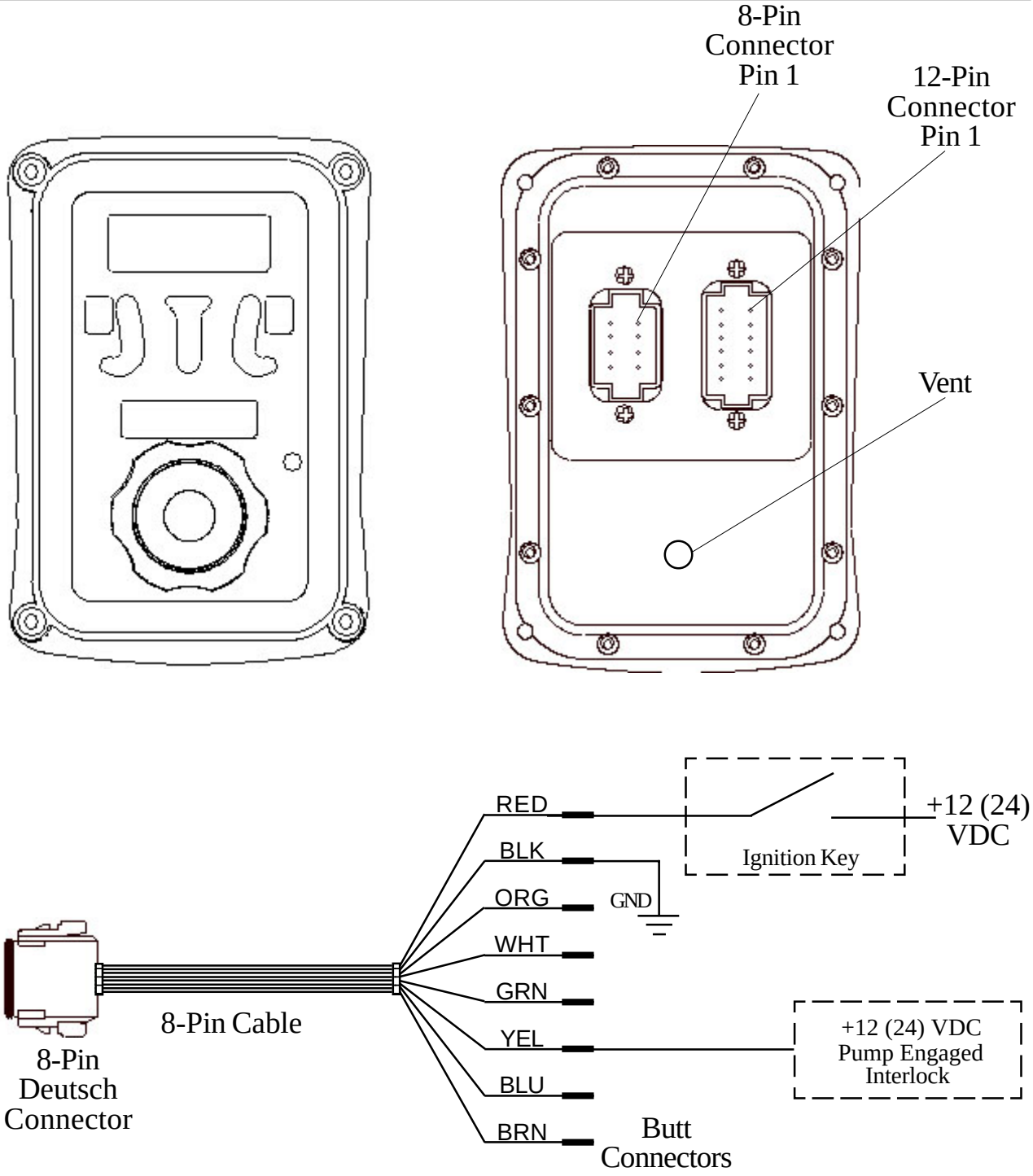


12 Pin Connector/Cable

Pin	Wire Color	Description
1	NC	-
2	NC	-
3	NC	-
4	Blue	Engine Oil Press. Sensor Signal
5	Organe	Engine Coolant Temp. Sensor Signal
6	Brown	Buzzer Ground (300mA)
7	Violet	High Idle Active Input (+12 VDC)
8	NC	-
9	Black	CAN J1939 (–)
10	Red	CAN J1939 (+)
11	Green	Transmission Temp. Sensor Signal
12	Yellow	RPM Signal

Notes:
- Not all wires are used for all engines. Refer to the engine specific wiring diagram for interface connections.
- For Ford 6.0L engines the yellow RPM signal wire, 12-pin connector pin 12, should be connected to the Clean Tachometer Output [green/white wire, circuit #76].
- An adapter and cable assembly replaces the basic 8-pin cable when connecting the ThrottleXcel to a Ford 6.0 or GMC engine. Refer to the engine specific wiring diagram.

Figure 6. Remote Engine Throttle and Display



8 Pin Connector/Cable

Pin	Wire Color	Description
1	Red	Supply Voltage (9 to 30 VDC)
2	Black	Ground
3	Orange	+5 VDC Reference From ECM
4	White	Throttle Signal To ECM
5	Green	Signal Return From ECM
6	Yellow	Interlock Input (12 or 24 VDC)
7	Blue	Throttle Enable Signal Output
8	Brown	Foot Pedal Signal Input

Pressure Governor

The **PRO-S** pressure governor uses state of the art programmable microprocessor technology. It will maintain a steady pump discharge pressure by controlling the engine speed or maintain a selected engine RPM. The **PRO-S** will operate in one of two modes, pressure or RPM.

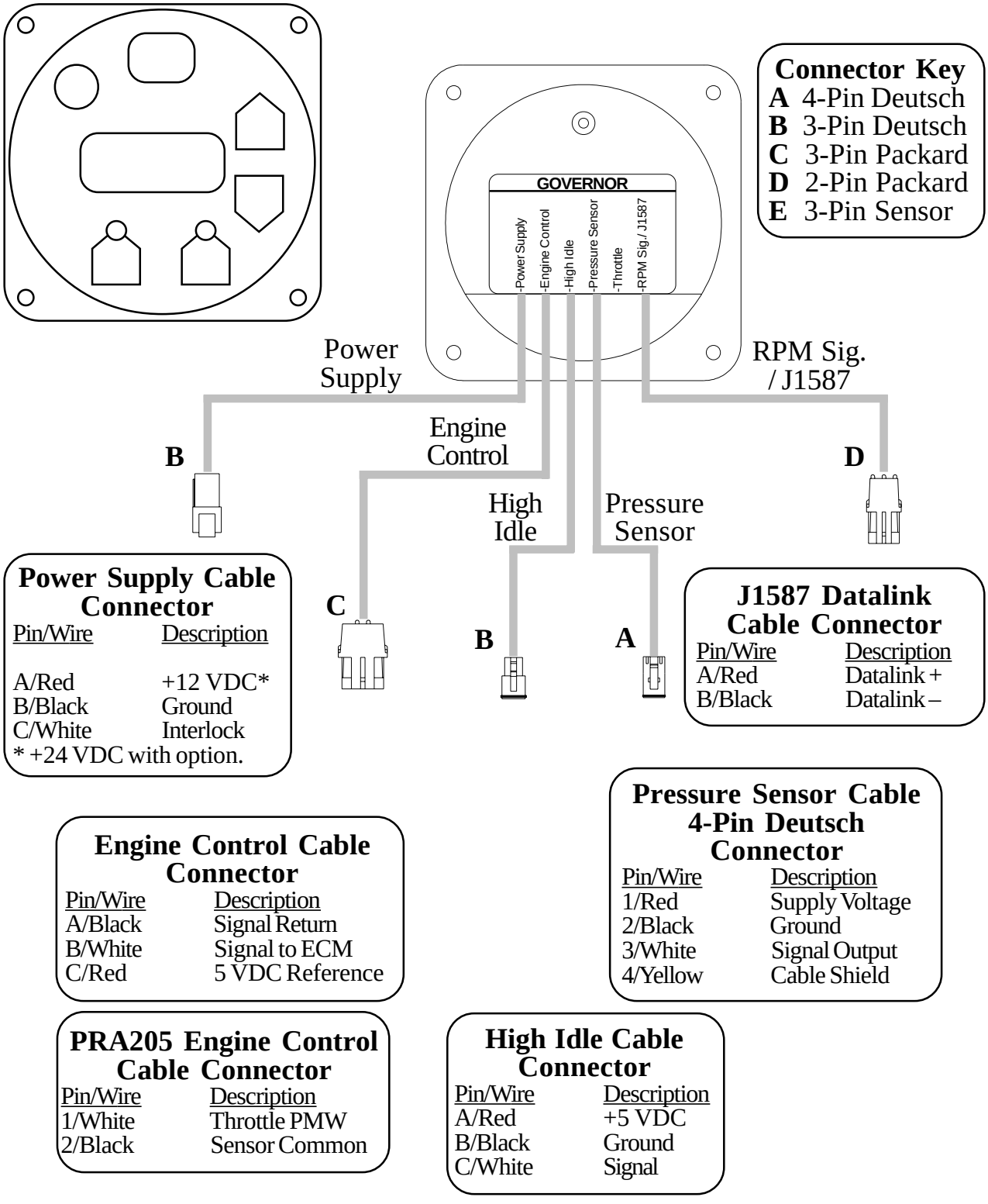


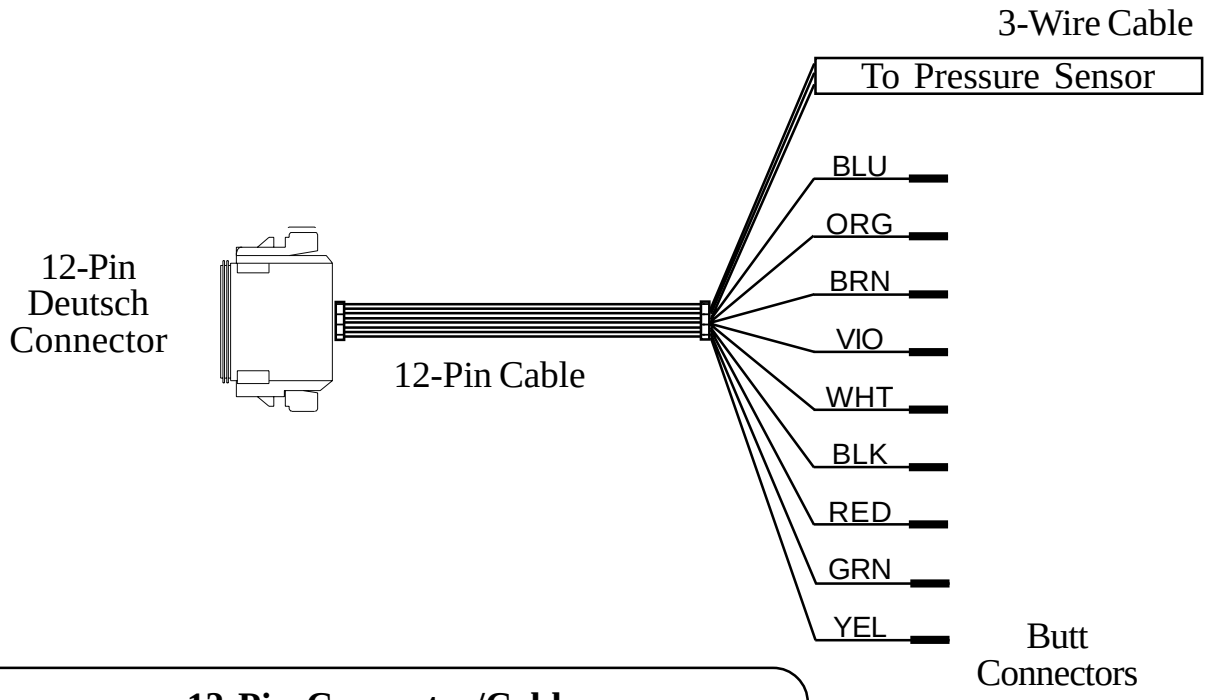
Figure 7. Pressure Governor

This page intentionally left blank.

PumpBoss

Pressure Gorernor and Engine Display

The **PumpBoss** pressure governor uses state of the art programmable microprocessor technology and operates in one of two modes, pressure or RPM. It will maintain a steady pump discharge pressure within system capabilities by controlling the engine speed. When selected, it will also maintain a selected engine RPM.

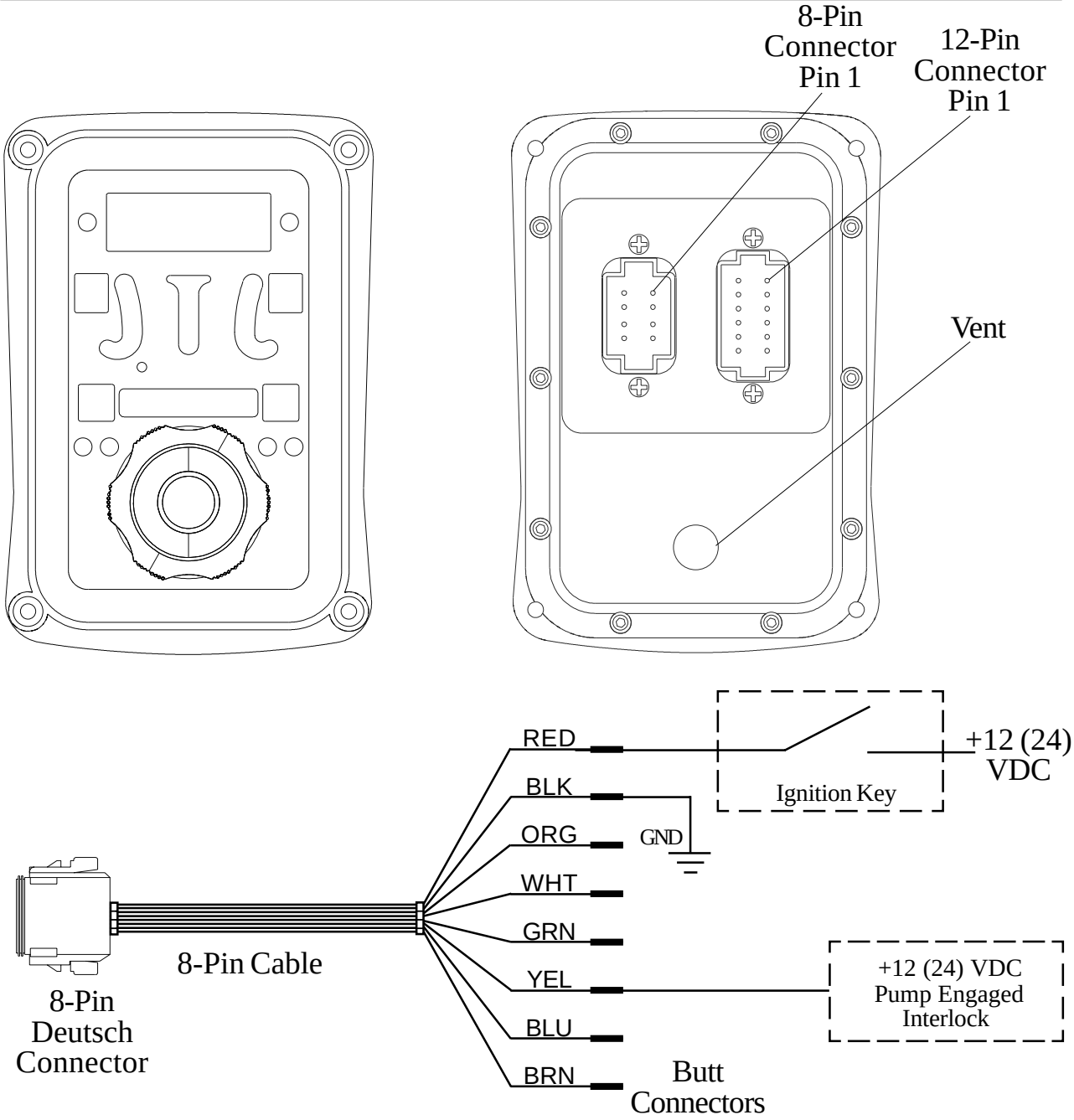


12 Pin Connector/Cable

Pin	Wire Color	Description
1	Red	+ 5 VDC Pressure Sensor
2	Black	Ground Pressure Sensor
3	White	Signal Pressure Sensor
4	Blue	Engine Oil Press. Sensor Signal
5	Orange	Engine Temp. Sensor Signal
6	Brown	Buzzer Ground (300mA)
7	Violet	High Idle Active Input (+12 VDC)
8	White	Check Engine LED Input (+12 VDC)
9	Black	CAN J1939 (–)
10	Red	CAN J1939 (+)
11	Green	Transmission Temp. Sensor Signal
12	Yellow	RPM Signal

Note: Not all wires are used for all engines. Refer to the engine specific wiring diagram for interface connections.

Figure 8. Pressure Governor and Engine Display



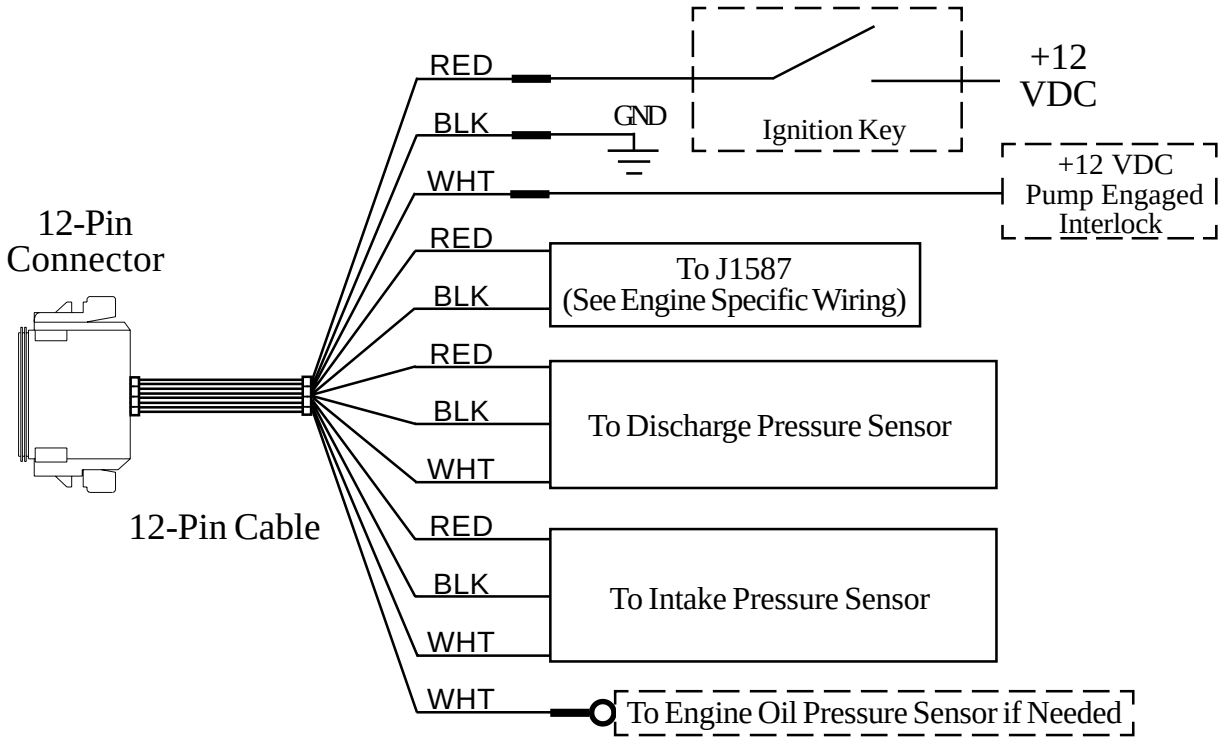
8 Pin Connector/Cable

Pin	Wire Color	Description
1	Red	Supply Voltage (9 to 30 VDC)
2	Black	Ground
3	Orange	+5 VDC Reference From ECM
4	White	Throttle Signal To ECM
5	Green	Signal Return From ECM
6	Yellow	Interlock Input (12 or 24 VDC)
7	Blue	Throttle Enable Signal Output
8	Brown	Foot Pedal Signal Input

INControl

Pressure Governor and Engine Display

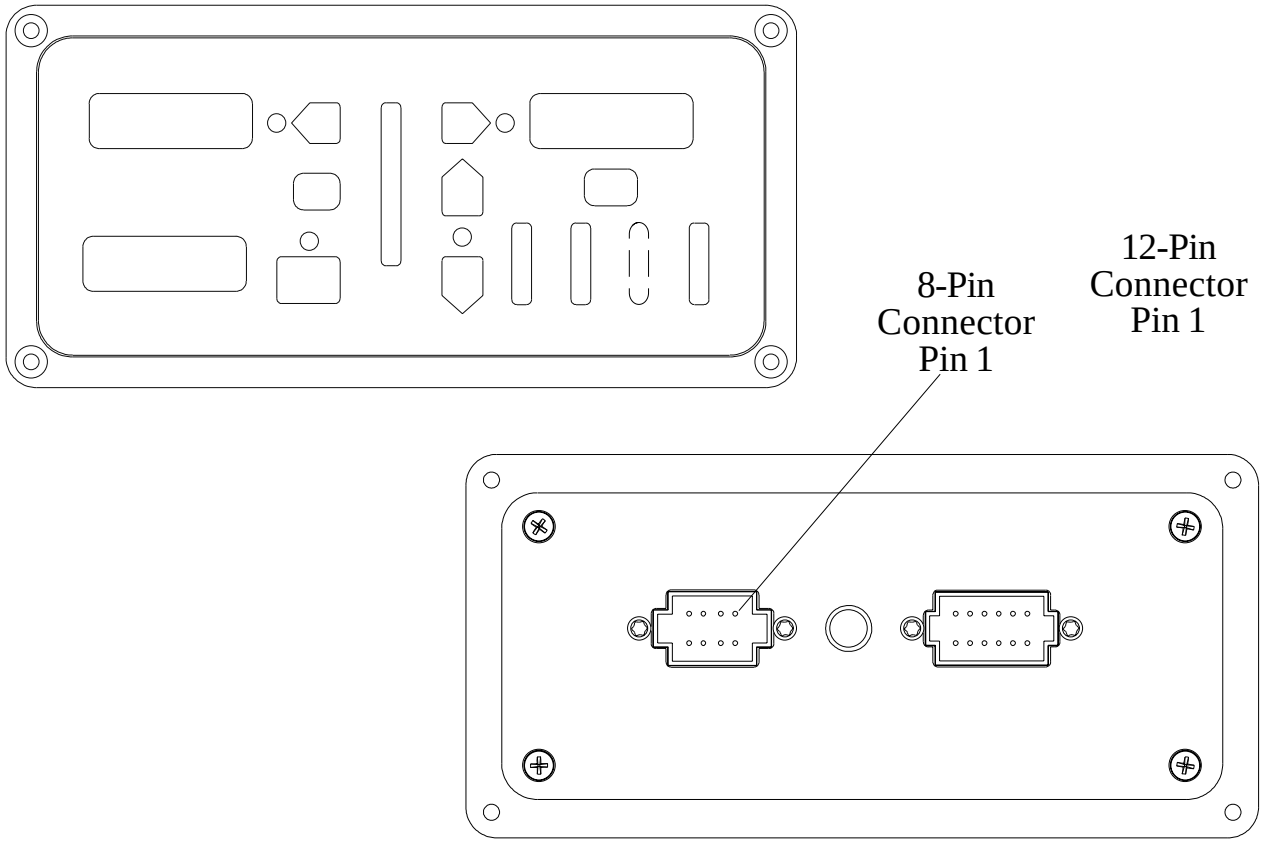
The **INControl** pressure governor and all-in-one instrument panel uses state of the art programmable microprocessor technology. It will maintain a steady pump discharge pressure by controlling engine speed or hold a selected engine RPM. It offers complete engine control and remote display in a single compact unit.

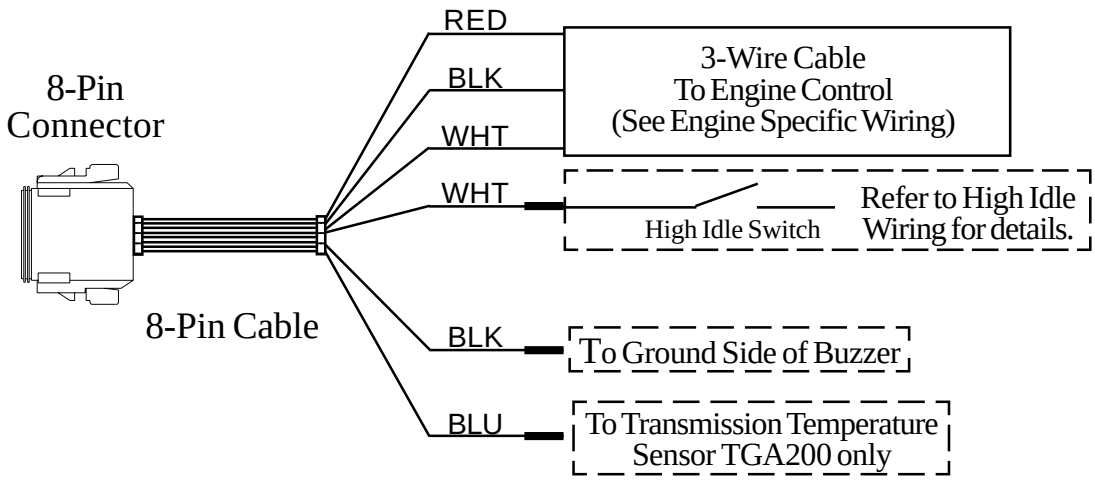


12 Pin Connector/Cable

Pin	Wire Color	Description
1	Red	+12 VDC Supply Voltage
2	Black	Ground
3	White	Interlock Input (+12 VDC)
4	Red	J1587 (+)
5	Black	J1587 (–)
6	Red	+5 VDC Discharge Sensor
7	Black	Ground Discharge Sensor
8	White	Signal Discharge Sensor
9	Red	+5 VDC Intake Sensor
10	Black	Ground Intake Sensor
11	White	Signal Intake Sensor
12	White	Engine Oil Pressure Senor

Figure 9. Pressure Governor with Pressure and Engine Displays

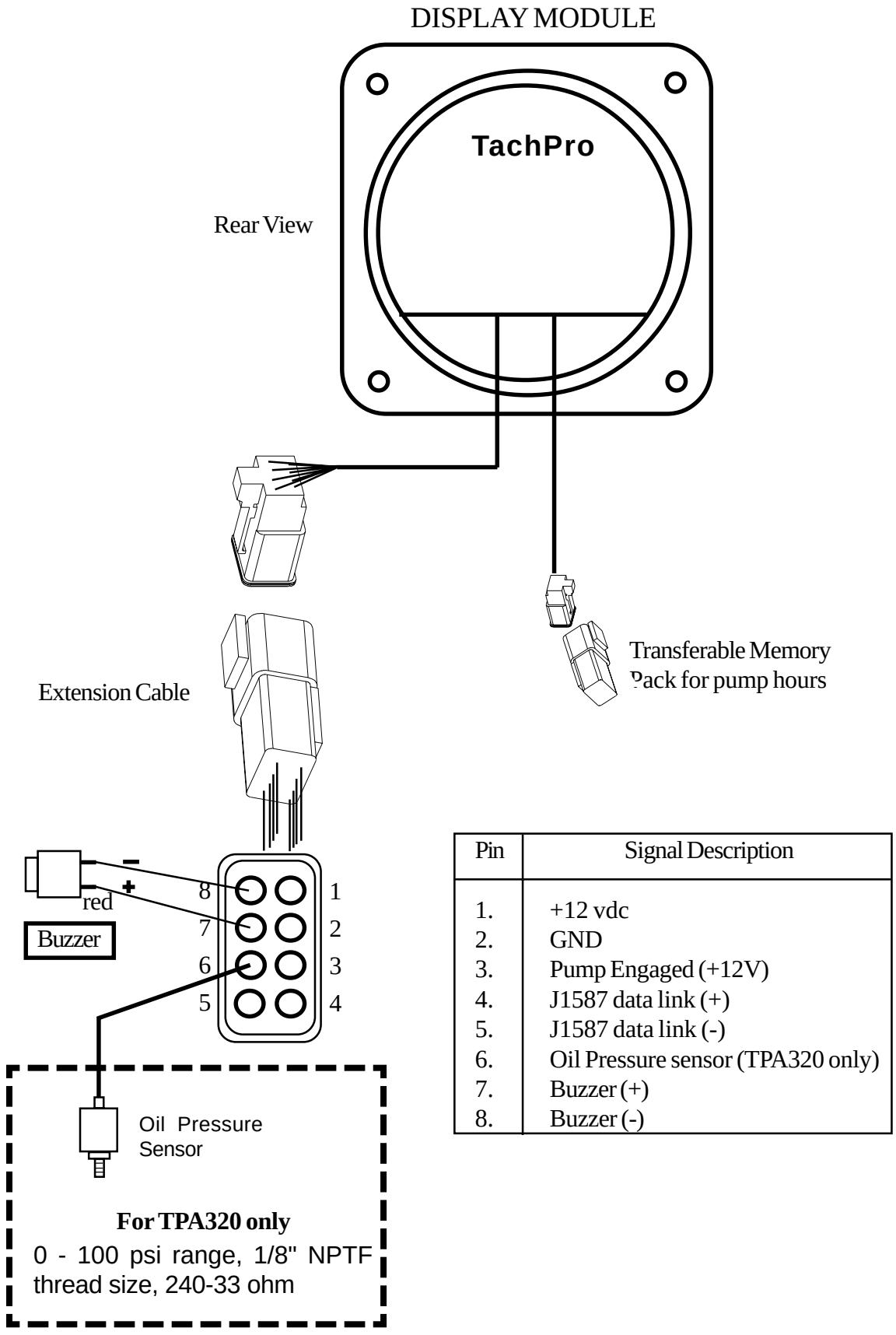




8 Pin Connector/Cable

Pin	Wire Color	Description
1	Red	+5 VDC Reference From ECM
2	Black	ECM Ground
3	White	Engine Control Signal To ECM
4	White	High Idle Active Input (Ground)
5	N/C	N/C
6	N/C	N/C
7	Black	Buzzer Ground
8	Blue	Transmission Temp. Sensor

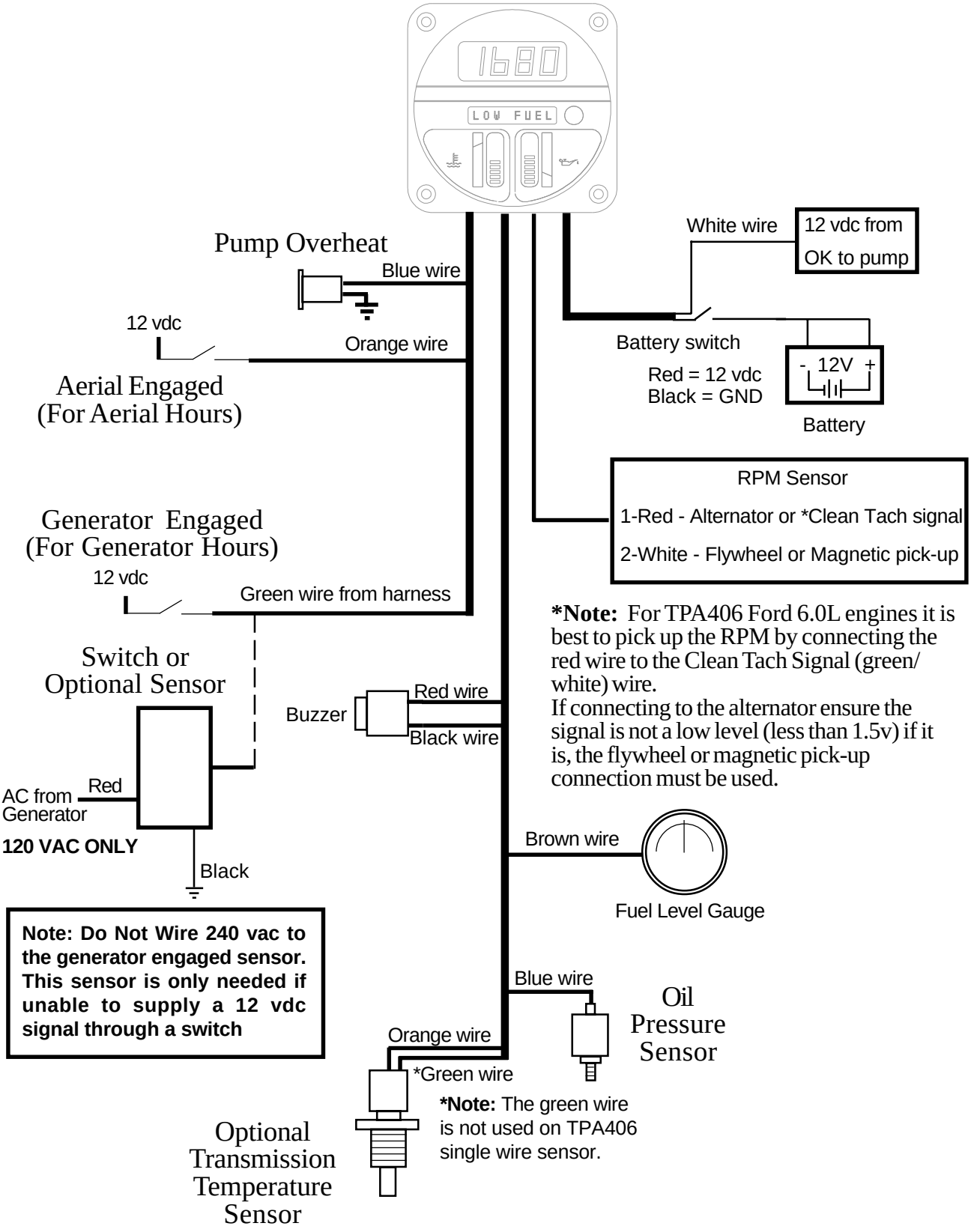
TACH PRO



Pin	Signal Description
1.	+12 vdc
2.	GND
3.	Pump Engaged (+12V)
4.	J1587 data link (+)
5.	J1587 data link (-)
6.	Oil Pressure sensor (TPA320 only)
7.	Buzzer (+)
8.	Buzzer (-)

Figure 10. Engine Displays

TACH Plus


LOW FUEL
Pump Overheat
Blue wire
12 vdc
Orange wire
Aerial Engaged
(For Aerial Hours)
White wire
12 vdc from
OK to pump
Battery switch
Red = 12 vdc
Black = GND
- 12V +
Battery
RPM Sensor
1-Red - Alternator or *Clean Tach signal
2-White - Flywheel or Magnetic pick-up
Generator Engaged
(For Generator Hours)
12 vdc
Green wire from harness
*Note: For TPA406 Ford 6.0L engines it is best to pick up the RPM by connecting the red wire to the Clean Tach Signal (green/ white) wire.
If connecting to the alternator ensure the signal is not a low level (less than 1.5v) if it is, the flywheel or magnetic pick-up connection must be used.
Switch or
Optional Sensor
Buzzer
Red wire
Black wire
AC from
Generator
Red
120 VAC ONLY
Black
Brown wire
Fuel Level Gauge
Note: Do Not Wire 240 vac to the generator engaged sensor. This sensor is only needed if unable to supply a 12 vdc signal through a switch
Blue wire
Oil
Pressure
Sensor
Orange wire
*Green wire
*Note: The green wire is not used on TPA406 single wire sensor.
Optional
Transmission
Temperature
Sensor

FROG

Generator Governor and Display

The **FROG** is a generator governor and generator output display panel in one unit. This governor will regulate engine RPM to help maintain steady generator frequency regardless of the engine or generator load.

The FRA102 (for Detroit Diesel engines) is based on the FROG-D platform and has a few differences.

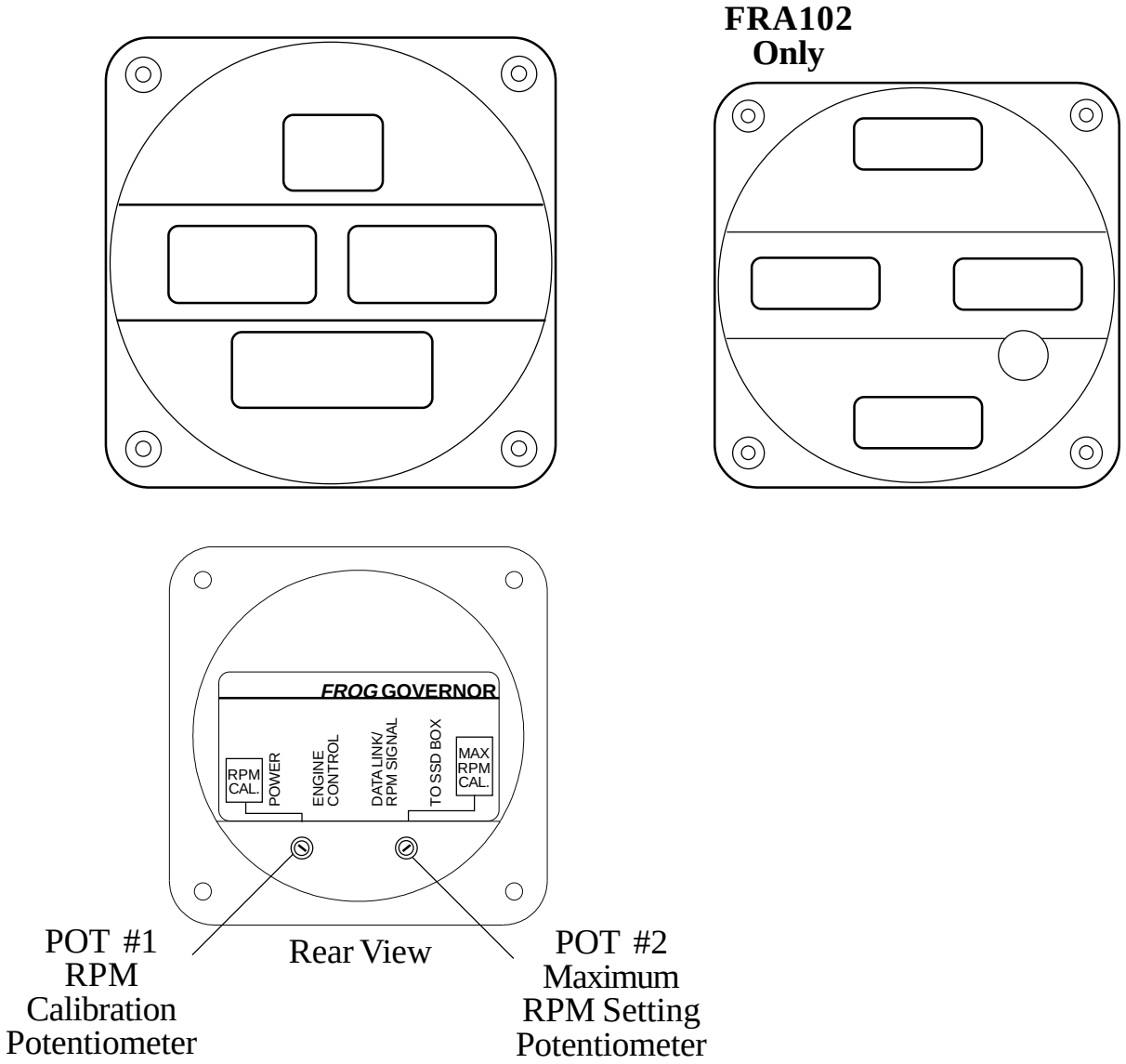
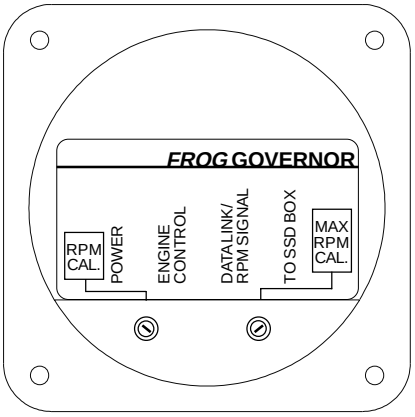


Figure 11. Generator Governor and Display



Connector Key
A 6-Pin Deutsch
B 3-Pin Deutsch
C 3-Pin Packard
D 2-Pin Packard

Power Supply

Signal Sensor Decoder

B

Engine Control

Datalink/ RPM Signal

A

Standard Cable to Signal Sensor Decoder Box Except FRA102

C

D

Power Supply Cable Connector

Pin/Wire	Description
A/Red	+12 VDC
B/Black	Ground
C/White	Interlock

Engine Control Cable Connector

Pin/Wire	Description
A/Black	Signal Return
B/White	Signal to ECM
C/Red	5 VDC Reference

J1587 Datalink Cable Connector

Pin/Wire	Description
A/Red	Datalink +
B/Black	Datalink –

FRA105 Engine Control Cable Connector

Pin/Wire	Description
1/White	Throttle PMW
2/Black	Sensor Common

FRA102 Only

FRA102 Options Cable Connector

Pin/Wire	Description
1/Red	+12 Volts Red
2/Black	Temp Sensor Black
3/White	Temp Sensor Green
4/Yellow	Buzzer GND

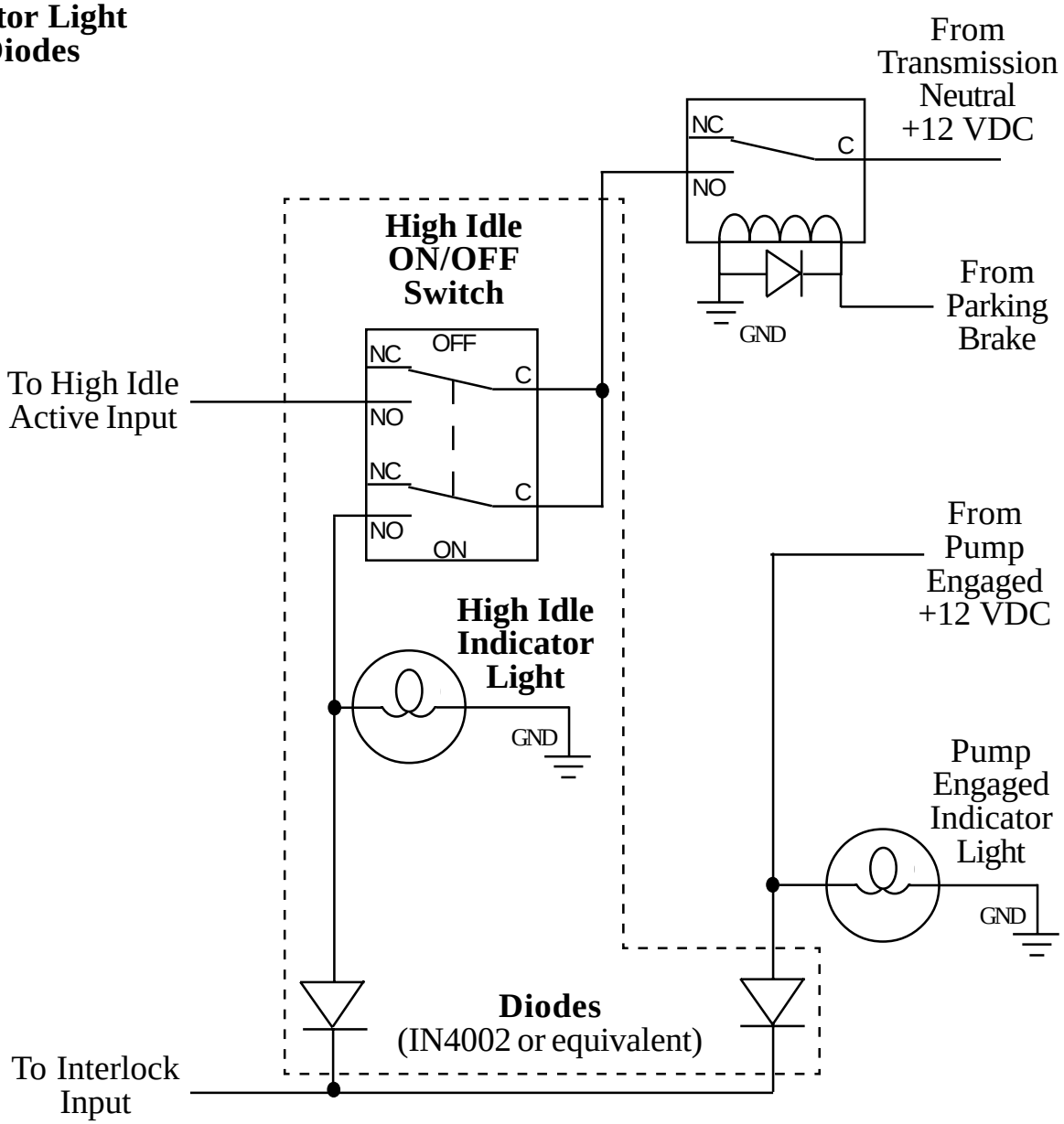
FRA102 AC Sensor Cable Connector

Pin/Wire	Description
1/Blue	Line 1 Sensor BLK
2/Orange	Line 2 Sensor WHT
3/Green	Line 1 Sensor WHT
4/Brown	Line 2 Sensor BLK
5/Black	AC Transformer BLU
6/Red	AC Transformer BLU

HIGH IDLE WIRING

Note: It is important that the connection to the Interlock Input from the High Idle circuit be isolated from the apparatus interlock wiring with the two diodes. Refer to the wiring diagram. **The pump must NOT be engaged when using the high idle function.**

A High Idle Kit is available from FRC.
P/N XE-TG38HK
Includes:
ON/OFF Switch
Indicator Light
Two Diodes

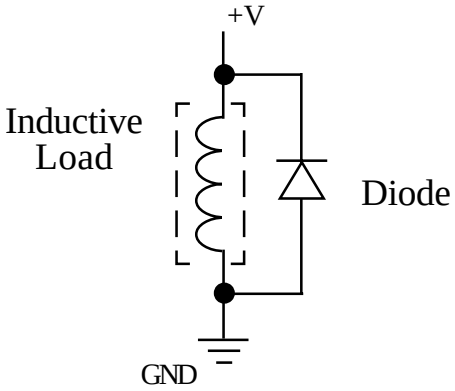


Note: Not typical for PRO-S or RTU series.

Figure 12. High Idle Wiring

FLYBACK DIODE INFORMATION

It is good engineering pratice to include a flyback diode when switching an inductive load (solenoid coil, relay coil, electric motor winding, etc.). It is recommended that a flyback diode be installed on inductive devices that share a common power source/ ground with a FRC governor.



Typical circuit showing a flyback diode installed across an inductive load.

Diagram showing a flyback diode connected on a typical pump primer motor solenoid.

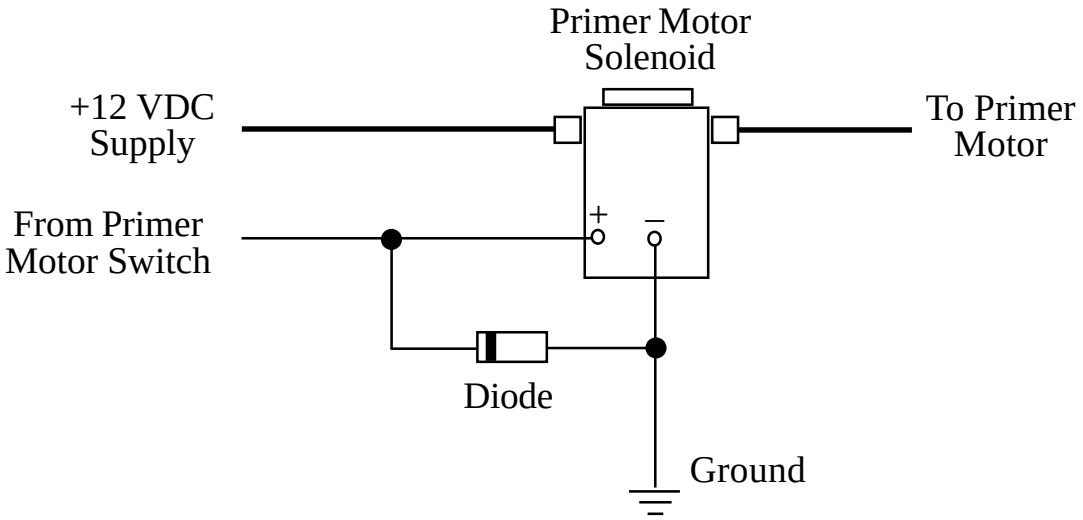


Figure 13. Flyback Diode

ELECTRICAL COMPONENTS

Resistors

Most resistors have three colored bands close together at one end and one single tolerance band at the other.

The three adjacent bands give the resistor value:

The band nearest the wire lead gives the value of the first digit.

The next band gives the value of the next digit

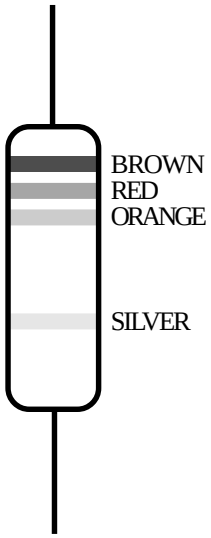
The third band gives the number of zeros which follows the two digits.

For example a resistor with brown, red, orange bands would have a value of 12000 ohms. The single band gives the tolerance, a resistor with a silver band wuold have a tolerance of ±10%.

Precision resistors may have 4 adjacent bands where the third would be the next digit and the fourth would give the number of zeros.

Table 1. Resistor Color Code

0	**BLACK**
1	**BROWN**
2	**RED**
3	**ORANGE**
4	**YELLOW**
5	**GREEN**
6	**BLUE**
7	**VIOLET**
8	**GRAY**
9	**WHITE**
Tolerance Band	
5%	**GOLD**
10%	**SILVER**
20%	**NO BAND**



Switch Types

SPST

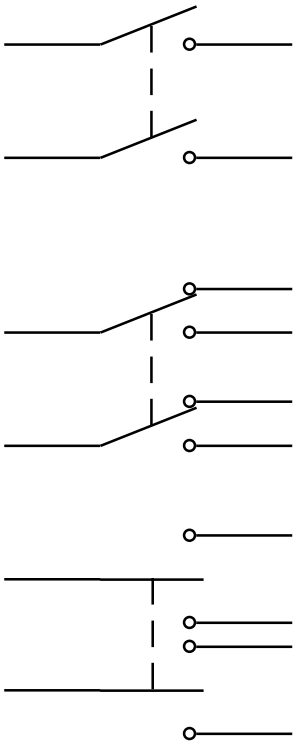
Single Pole Single Throw
one input to one output 2-position switch on/off

SPDT

Single Pole Double Throw
one input to two output 2-position switch on/on

SPCO

Single Pole Center Off
one input to two output 3-position switch on/off/on



DPST

Double Pole Single Throw
two input to two output 2-position switch on/off

DPDT

Double Pole Double Throw
two input to two output 2-position switch on/on

DPCO

Double Pole Center Off
two input to two output 3-position switch on/off/on

Figure 14. Switches

CONVERSIONS

English to Metric Pressure

To Change from

Pounds Per Square Inch to Kilopascals: psi x 6.895 = kPa

Pounds Per Square Inch to Bar: psi x .0689 = bar

To Change from

Kilopascals to Pounds Per Square Inch: kPa x .145 = psi

Bar to Pounds Per Square Inch: bar x 14.503 = psi

Table 2. PSI to kPa to BAR

PSI	kPa	BAR
50	345	3.45
60	414	4.14
70	488	4.88
80	552	5.52
90	621	6.21
100	690	6.90
150	1034	10.34
200	1379	13.79
250	1723	17.23
300	2069	20.69
350	2413	24.13
400	2758	27.58
450	3103	31.03
500	3448	34.48
550	3792	37.92
600	4137	41.37
700	4827	48.27
800	5516	55.16
900	6206	62.06

English to Metric Flow

To Change from

Gallons Per Minute to Liters Per Minute: gpm x 3.785 = lpm

To Change from

Liters Per Minute to Gallons Per Minute : lpm x .2642 = gpm

Table 3. GPM to LPM

GPM	LPM
10	37.85
15	56.78
20	75.70
25	94.62
30	113.6
40	151.4
50	189.3
60	227.1
70	265
80	302.8
90	340.7
100	378.5
125	473.1
150	567.8
175	662.4
200	757
250	946.3
300	1136
350	1325
400	1514
450	1703
500	1893
600	2271
700	2650
800	3028
1000	3785
1100	4164
1200	4542
1300	4920
1500	5678
2000	7570

English to Metric Length

	To Change from
Inches to Millimeters:	**in x 25.4 = mm**
Yards to Meter:	**yd x .914 = m**
Miles to Kilometers:	**ml x 1.609 = km**

	To Change from
Millimeters to Inches:	**mm x 0.039 = in**
Meters to Yards:	**m x .094 = yd**
Kilometers to Miles:	**km x .621 = ml**

Table 4. Metric Equivalents to Decimals of an Inch

MM	Inch	MM	Inch	MM	Inch	MM	Inch
.1	= .00394	1.	= .03937	11.	= .43307	21.	= .82677
.2	= .00787	2.	= .07874	12.	= .47244	22.	= .86614
.3	= .01181	3.	= .11811	13.	= .51181	23.	= .90551
.4	= .01575	4.	= .15748	14.	= .55118	24.	= .94488
.5	= .01968	5.	= .19685	15.	= .59055	25.	= .98425
.6	= .02362	6.	= .23622	16.	= .62992		
.7	= .02756	7.	= .27559	17.	= .66929		
.8	= .03149	8.	= .32496	18.	= .70866		
.9	= .03543	9.	= .35433	19.	= .74803		
		10.	= .39370	20.	= .78740		

12.7 = .5 inch
25.4 = 1.0 inch

Fractions to Decimal to Metric

Table 5. Fractions, Decimals and Metric Equivalents

Fraction	Decimal	MM	Fraction	Decimal	MM
1/64"	.015"	.396	33/64"	.516"	13.096
1/32"	.031"	.795	17/64"	.531"	13.495
3/64"	.047"	1.191	35/64"	.547"	13.891
1/16"	.063"	1.588	9/16"	.563"	14.288
5/64"	.078"	1.984	37/64"	.578"	14.684
3/32"	.094"	2.383	19/32"	.594"	15.083
7/64"	.109"	2.779	39/64"	.609"	15.479
1/8"	.125"	3.175	5/8"	.625"	15.875
9/64"	.141"	3.571	41/64"	.641"	16.271
5/32"	.156"	3.970	21/32"	.656"	16.670
11/64"	.172"	4.366	43/64"	.672"	17.066
3/16"	.188"	4.763	11/16"	.688"	17.463
13/64"	.203"	5.159	45/64"	703"	17.859
7/32"	.219"	5.558	23/32"	.719"	18.254
15/64"	.234"	5.954	47/64"	.734"	18.654
1/4"	.250"	6.350	3/4"	.750"	19.050
17/64"	.266"	6.746	49/64"	.766"	19.446
9/32"	.281"	7.145	25/32"	.781"	19.845
19/64"	.297"	7.541	51/64"	.797"	20.241
5/16"	.313"	7.938	13/16"	.813"	20.638
21/64"	.328"	8.334	53/64"	.828"	21.034
11/32"	.344"	8.733	27/32"	.844"	21.433
23/64"	.359"	9.129	55/64"	.859"	21.821
3/8"	.375"	9.525	7/8"	.875"	22.225
25/64"	.391"	9.921	57/64"	.891"	22.621
13/32"	.406"	10.320	29/32"	.906"	23.020
27/64"	.421"	10.716	59/64"	.922"	23.416
7/16"	.438"	11.113	15/16"	.938"	23.813
29/64"	.453"	11.509	61/64"	.953"	24.209
15/32"	.469"	11.908	31/32"	.969"	24.608
31/64"	.484"	12.304	63/64"	.984"	25.004
1/2"	.500"	12.700	1"	1.000"	25.400

Temperature Conversion

To Change from Fahrenheit to Celsius:

(°F – 32) x 5/9 = °C

To Change from Celsius to Fahrenheit:

(°C x 9/5) + 32 = °F

To Change from Celsius to Kelvin:

°C + 273.4 = °K

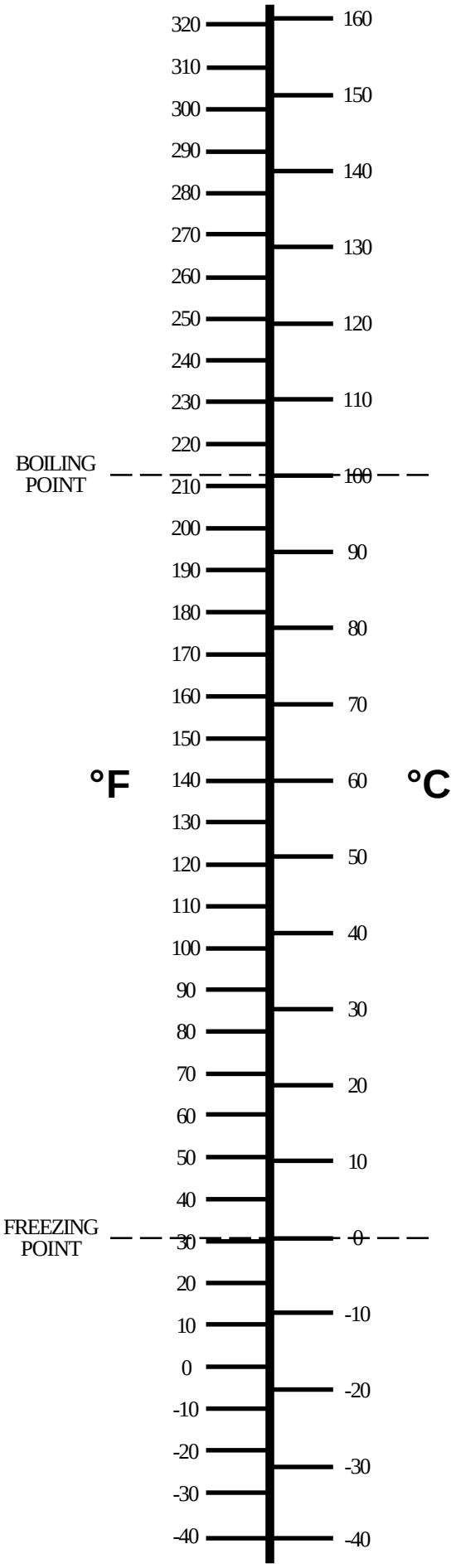


Figure 15. Temperature Conversion

DRILLING REFERENCE

Screw/Tap Drill / Clearance Holes

Table 6. Screw - Tap Drill - Clearance Hole Drill

Size of Screw			Tap Drill		Clearance Hole Drills			
					Close Fit		Free Fit	
# or Dia.	Decimal (inch)	Threads Per Inch	Drill Size	Decimal (inch)	Drill Size	Decimal (inch)	Drill Size	Decimal (inch)
#0	0.06	80	3/64	0.0469	52	0.0635	50	0.07
#1	0.073	64	53	0.0595	48	0.076	46	0.081
#1	0.073	72	53	0.0595	48	0.076	46	0.081
#2	0.086	56	50	0.07	43	0.089	41	0.096
#2	0.086	64	50	0.07	43	0.089	41	0.096
#3	0.099	48	47	0.0785	37	0.104	35	0.11
#3	0.099	56	45	0.082	37	0.104	35	0.11
#4	0.112	36	44	0.086	32	0.116	30	0.1285
#4	0.112	40	43	0.089	32	0.116	30	0.1285
#4	0.112	48	42	0.0935	32	0.116	30	0.1285
#5	0.125	40	38	0.1015	30	0.1285	29	0.136
#5	0.125	44	37	0.104	30	0.1285	29	0.136
#6	0.138	32	36	0.1065	27	0.144	25	0.1495
#6	0.138	40	33	0.113	27	0.144	25	0.1495
#8	0.164	32	29	0.136	18	0.1695	16	0.177
#8	0.164	36	29	0.136	18	0.1695	16	0.177
#10	0.19	24	25	0.1495	9	0.196	7	0.201
#10	0.19	32	21	0.159	9	0.196	7	0.201
#12	0.216	24	16	0.177	2	0.221	I	0.228
#12	0.216	28	14	0.182	2	0.221	I	0.228
#14	0.242	20	10	0.1935	D	0.246	F	0.257
#14	0.242	24	7	0.201	D	0.246	F	0.257
1/4	0.25	20	7	0.201	F	0.257	H	0.266
1/4	0.25	28	3	0.213	F	0.257	H	0.266
5/16	0.3125	18	F	0.257	P	0.323	Q	0.332
5/16	0.3125	24	I	0.272	P	0.323	Q	0.332
3/8	0.375	16	5/16	0.3125	W	0.386	X	0.397
3/8	0.375	24	Q	0.332	W	0.386	X	0.397
7/16	0.4375	14	U	0.368	29/64	0.4531	15/32	0.4687
7/16	0.4375	20	25/64	0.3906	29/64	0.4531	15/32	0.4687
1/2	0.5	13	27/64	0.4219	33/64	0.5156	17/32	0.5312
1/2	0.5	20	29/64	0.4531	33/64	0.5156	17/32	0.5312