Installation & Operating Manual

Speed+ Speed Monitor for PLC

Form Speed+ IOM 10-14

altronic
HOERBIGER Engine Solutions

ODVA APPROVAL PENDING

1.0 PLC+ Function-Specific I/O Modules

1.1 The PLC+ product line was developed by Altronic to allow easy integration of engine/compressor/generator function specific I/O through Ethernet to industry standard PLCs. The PLC+ Modules are designed to seamlessly deliver efficient, hazardous area approved, cost effective I/O functions that are not normally available by off-the-shelf PLC hardware.

1.2 The PLC+ modules were designed with Rockwell Automation Control Logix and Compact Logix controllers in mind. EtherNet/IP implemented in the PLC+ Modules, along with Modbus/TCP allow seamless communication over Ethernet to Rockwell Automation PLCs as well as a wide range of other industrial PLCs.

1.3 The PLC+ monitors are based upon taking a time tested Altronic designed and tested specialty I/O function such as analog and digital I/O, vibration, detonation, speed, and others and marrying it to a communications board packaged in a rugged, cost effective shock and dust-resistant package.

WARNING: Deviation from this installation/operating manual may lead to improper operation of the monitored machine which could cause personal injury to operators or other nearby personnel.

CAUTION: The Speed+ Speed Monitor is certified for use in Class I, Groups C & D, Division 2 hazardous locations when installed in accordance with these instructions.

The input leads connected to this device operate at a low voltage and power level and MUST NOT CONTACT any external voltage source. Damage to the system will result from connection between the low voltage leads and the ignition system or any AC or DC power source above 36 Vdc.

WARNING: The Speed+ must be configured prior to use.

2.0 Speed+ Description

2.1 The Speed+ Speed Monitor is a module in the PLC+ product line. It converts engine and rotating equipment speed to Ethernet/IP or Modbus TCP for use in PLC's to monitor and control processes. The speed input pulse can come from magnetic, Hall-effect, or other types of active pickups or from C.D. Ignition Systems. An isolated square wave speed output signal that is proportional to the speed input signal with its amplitude equal to the voltage supplied on the VCC terminal (an open collector output) is available as a speed input signal to other devices. The calculated speed output can be at selected ratios to the measured RPM. Speed range is up to 65000 RPM. A configurable, 4-20MA analog output signal with respect to speed is offered for the control of Altronic Ignition systems, electronic governor, valves, actuators, and other devices commonly used in process control. The Speed+ has three adjustable setpoints that can be individually mapped to either or both of the two output switches.

2.2 The Speed+ is designed for use as a component of a PLC+ Control Panel, or as a stand-alone product. PLC+ panels use one or more such devices for engine control and monitoring. The Ethernet port allows the monitored values to be communicated to a PC, PLC,or other communications device using either Modbus/TCP or EtherNet/IP protocol. These values can be displayed on an HMI display and compared to user adjustable setpoint levels for sequencing, and/or alarm and shutdown.

2.3 The SPEED+ is housed in a 4.5" x 4.25" rugged anodized aluminum case. It mounts on a DIN rail using the DIN-rail-clip on the back of the unit. Pluggable Phoenix Contact-type connectors with push-in spring-cage connectors are used for connections. A standard RJ45 connector is used for Ethernet communications. The power requirement is 10 to 32Vdc, 0.25Amp max.

2.4 For proper operation, these instructions must be adhered to strictly.

3.0 Mounting

WARNING: This monitor is OPEN type equipment that must be used within a suitable enclosure.

3.1 Mount the Speed+ inside a control panel or to a suitable flat surface. A DIN-rail-mounting-clip on the back of the unit is used to mount the unit on a standard 35mm DIN rail. When mounting the Monitor to the DIN rail, angle the top of the unit towards the rail and slide the top of the clip over the top of the rail. Firmly push the unit towards the rail until it snaps into place. To remove, grasp the Monitor firmly on the top of the unit and apply downward pressure to compress the latch spring. Rock the bottom of the unit away from the rail.

4.0 Wiring and Description (SEE WIRING DIAGRAMS)

4.1 GENERAL

Take care not to damage the insulation and take precautions against damage from vibration, abrasion or liquids in conduits. Never run sensor, low voltage power, current loop, communications, or output switch wires in the same conduit as the ignition wiring or other high energy wiring such as AC line power, etc. Keep wires at least 12 inches away from all high voltage wiring.

Keep secondary wires to spark plugs and other high voltage wiring at least 12 inches (205mm) away from low voltage wiring to the Speed+.

NOTE: Altronic HIGHLY RECOMMENDS the use of resistor spark plugs and/or spark plug leads with all digital instrumentation as a means of reducing the impact of RFI (radio frequency interference) on operation.

4.2 POWER WIRING

Connect the power input wires to terminals (DC+) and (DC-); power requirement is 10 to 32Vdc, 0.25Amp max. Connect the minus terminal (DC-) to panel ground, which must be the same as the ground on the monitored device. This device must be powered from a Class 2 power supply. It is recommended that the current from the power supply to the Monitor be limited through a properly sized surge tolerant fuse or electronic breaker.

WARNING: DO NOT connect the minus terminal directly to AN IGNITION SYSTEM COMMON COIL GROUND ON THE ENGINE.

4.3 SPEED INPUT WIRING

The RPM IN inputs are isolated from DC-. The GT and COM input is the low voltage input intended for pickups. The IGN and COM inputs are high voltage inputs intended for ignition system shutdown leads. Connect the speed input to the terminals marked RPM IN.

- MAGNETIC PICK-UP — Connect the two wires from the 691118 series or similar magnetic pick-up to the Monitor at terminals GT and COM using cable assembly 693104 series.
- HALL-EFFECT PICK-UP — Connect the three wires from the 791050 series Hall-effect pick-up to the Monitor at terminals GT, COM, and a +5 volt source using cable assembly 593 050 series. Connect pick-up cable wire B to a +5V supply, wire A to terminal GT, and wire C to terminal COM (minus). In addition, a 10,000-ohm pull-up resistor must be placed across the +5V supply to GT of the Monitor.
- IGNITION COIL PRIMARY OR SHUTDOWN LEAD OF A C.D. IGNITION SYSTEM — Connect a wire from either an ignition coil primary or the shutdown lead of a C.D. ignition system to the Speed Monitor at terminals IGN and COM terminals. IGN is positive with respect to COM. The ground connection should be made by placing a short ground wire from the proper terminal on the Monitor to panel ground which should be the same as engine ground. Use a fine gauge stranded wire such as Altronic 603 102 (black) or 603103 (white) 24 AWG for connections. DO NOT connect the ground polarity terminal directly to the ignition system common coil ground on the engine.

WARNING: Do not disconnect equipment in Div. 2 environment unless power is switched off or the area is known to be non-hazardous.

Please be aware that the Speed+ is optimized to receive evenly spaced input pulses. The calculated RPM may be unsteady or read improperly for unevenly spaced input pulses that can appear on shutdown leads of odd firing and/or multi-strike ignition systems.

Consult the factory for workarounds for applications with unevenly spaced input pulses.

4.4 SPEED OUTPUT WIRING

Connect the speed output wires to the terminals marked RPM OUT. The Speed+ will condition the speed input signal to an amplified square wave output proportional to the voltage supplied on the VCC terminal. The output signal is isolated from DC minus. The output is open drain thus allowing for any output voltage between 3 and 30 volts. The output does not require an external pull-up resistor, a 1K ohm pull-up resistor is provided internally. Max sink current is 15mA. Connect a supply voltage of the desired output voltage in the range of 3 to 30 Vdc to terminal VCC. The conditioned output signal is on terminals OUT and GND.

4.5 OUTPUT SWITCH WIRING

Exceeding a setpoint value will cause the user-programmable output switch to turn ON/OFF with respect to its common. The Speed+ contains two output switches. Each switch can independently be configured. The outputs can be

used for alarm and shutdown, speed setpoints for control, rotation sensed and many other speed setpoint indications. Each switch can be mapped to any or all three Setpoints and or rotation sensed. These switches are solid state, form C (N/O and N/C) break-before-make contacts and are isolated from the power supply. Switch 1 is closed with the absence of power and switch 2 is open with the absence of power. The switches are rated at 32Vdc, 200mA and the N/O switch has a unique internal overload current protection circuit. If an overload occurs, the internal circuitry limits current to safe levels. When the overload is removed, the relay resumes its normal ON characteristics. These switches can be wired to engine management systems, an Altronic annunciator system or to pilot duty relays as shown by the wiring diagrams.

4.6 RJ45 ETHERNET COMMUNICATIONS WIRING

The Speed+ can communicate to other instruments, PCs, or PLCs via the Ethernet communications port. Use data grade Category 5E Shielded Twisted Pair (STP) or Unshielded Twisted-Pair (UTP) cable that has a 100Ω characteristic impedance that meets the EIA/TIA Category Five (CAT-5) wire specifications. Max wire length is 100 meters/325 feet.

NOTE: The use of Category 5E STP cable (Shielded Twisted Pair) with shielded RJ45 plug connectors is strongly recommended for installations in harsh industrial environments and/or in the presence of strong electrical fields.

4.7 CURRENT LOOP WIRING

The Speed+ has a 4-20 mA current loop available for the control of Altronic ignition systems, valves, actuators, and other devices commonly used in process control. The current loop's output is proportional to the RPM value read. It can be configured for forward or reverse acting. It can be configured anywhere within the range of the Monitor. The current loop output is accessible through terminals LOOP OUT and DC-. The output is protected against open and short circuits. A 250 ohm loop resistor can be used over the entire supply voltage range from 12 to 36 Vdc. The maximum load resistance that can be tolerated in the loop is determined by the supply voltage. When using the maximum rated loop resistor of 500 ohms with a desired full scale loop output of 20 mA, the supply voltage must be between 15 and 36 VDC. At 12 VDC supply voltage, the maximum load resistor for 20 mA loop output current is 350 ohms. Refer to the wiring diagrams for typical hook-up.

4.8 RESET WIRING

Remote reset is a configurable function. It can be configured to RESET or UNLATCH. When configured to RESET, and when grounded, the setpoints will go to their untripped state. Their associated timers will clear and start over. Both output switches, when set to latching, will be reset. When set to UNLATCH only the output switches when set to latching will be unlatched. The remote reset action is momentary. The reset action is active low. A momentary grounding of the reset terminal causes the reset action.

4.9 HAZARDOUS AREA OPERATION

The Speed+ is CSA certified for CLASS I, DIVISION 2, GROUPS C & D areas as a component only and is required to be installed in a suitable enclosure where the suitability of the combination is subject to the local inspection authority having jurisdiction. The power connections to the Speed+ must be in accordance with the National Electrical Code and in Canada, the Canadian Electrical Code. In addition, the following requirements must be met:

1. **Run the sensor wires leaving the panel in a separate conduit from all other wiring and keep them separate throughout the installation.**
2. **Power, input, and output wiring must have a grade of insulation capable of withstanding an AC voltage of 500 volts RMS.**
3. **In general, run wires in separate conduits and junction boxes from high voltage wires such as ignition, fuel valve, and other high voltage wiring**.

5.0 Overview

5.1 The SPEED+ Speed Monitor converts engine and rotating equipment speed to Ethernet/IP or Modbus TCP over Ethernet for use in PLC's to monitor and control processes. The Speed+ is designed for use as a component of a PLC+ Control Panel, or as a stand-alone product.

5.3 The speed input pulse can come from magnetic, Hall-effect, or other types of active pickups or from C.D. Ignition Systems.

5.4 The Speed+ is fully configurable via its on-board web page. Some of the parameters that can be configured are number of gear teeth, gear speed to display speed ratio, three setpoints, output current loop, and output switches.

5.5 The speed output can be at selected ratios to the measured RPM. Speed range is up to 65000 RPM. A configurable 4-20mA analog output signal with respect to speed is offered for direct process control or directly to an Altronic Ignition System for timing control.

5.6 The Speed+ has three adjustable setpoints that can be individually mapped to either or both of the two output switches. Switch 1 is normally closed and switch 2 is normally open with lack of power. These switches are isolated from ground and turn-on to switch common.

6.0 Front Panel LED Indicators

6.1 **POWER** – When the unit is powered, the green "POWER" LED will be on.

6.2 **STATUS** – The status indicator is multi-purpose. It contains several "blink" patterns.

- EtherNet/IP communications mode – one long, one short blink at 1/4-second rate
- Modbus/TCP communications mode – short blinks at 1/4 second rate
- "wink" mode – steady short blinks at 1/8 second rate for the selected time

6.3 **ETHERNET** – The Ethernet port contains two LED's that are built into the RJ45 connector. The green LINK LED will be on solid if the Ethernet port has successfully established a connection. The yellow RX/TX light signals network activity.

6.4 **OUTPUT SWITCH INDICATORS** – Each of the built-in output switches (SW1 and SW2) have an LED indicator. The LED turns on when the switch is activated.

7.0 Reset

7.1 Reset can be initiated in one of two ways: by pulling the remote reset terminal on the monitor low, or by sending a reset command via communications. Reset is configurable and can be set to RESET or UNLATCH.

- RESET resets the Start-Up Timers and places the output switches in the non-tripped condition
- UNLATCH unlatches the output switches when set to Latching

8.0 Setpoints

8.1 The Speed+ contains three fully configurable setpoints that can be set anywhere from one rpm to the configured maximum speed. The maximum speed is configured on the General Setup page. Since the speed range of the gauge is extensive (0 – 65000 rpm) the maximum speed setting is required and is used to zoom in on the desired range for the best resolution and accuracy.

9.0 Protocols

9.1 The PLC+ Monitors support EtherNet/IP (Ethernet Industrial Protocol) and Modbus/TCP (Modbus over TCP/IP).

9.2 EtherNet/IP – EtherNet/IP is a communication protocol developed and used by Rockwell Automation for use in their Allen Bradley brand PLCs. It is managed by Open DeviceNet Vendors Association (ODVA) (www.odva.org) and is designed for use in process control and other industrial automation applications. Some other vendors using EtherNet/IP are Omron, Schneider Electric, Harting, Phoenix Contact, Opto 22, Wago Corporation, and Yaskawa. EtherNet/IP uses objects to communicate to and from the PLC+ Monitors and the PLC. An object model is a collection of related data values and common elements of the PLC+ monitor. The object model is listed at the end of this manual.

9.3 Modbus/TCP – Modbus/TCP is Modbus over Ethernet. It is very similar to Modbus RTU. The Modbus registers are the same. The memory map of the Modbus registers are listed toward the end of this manual.

10.0 EDS File (Electronic Data Sheet)

10.1 The EDS file is used for Monitor configuration and to commission it on an EtherNet/IP network. It is an ASCII text file that describes the Monitors' device type, product revision, and its configurable parameters on the EtherNet/IP network.

10.2 An EDS file for the Speed+ can be found enclosed on the media with this document and on the Altronic ftp site; it may also be downloaded from the onboard web page.

11.0 Embedded Web Server

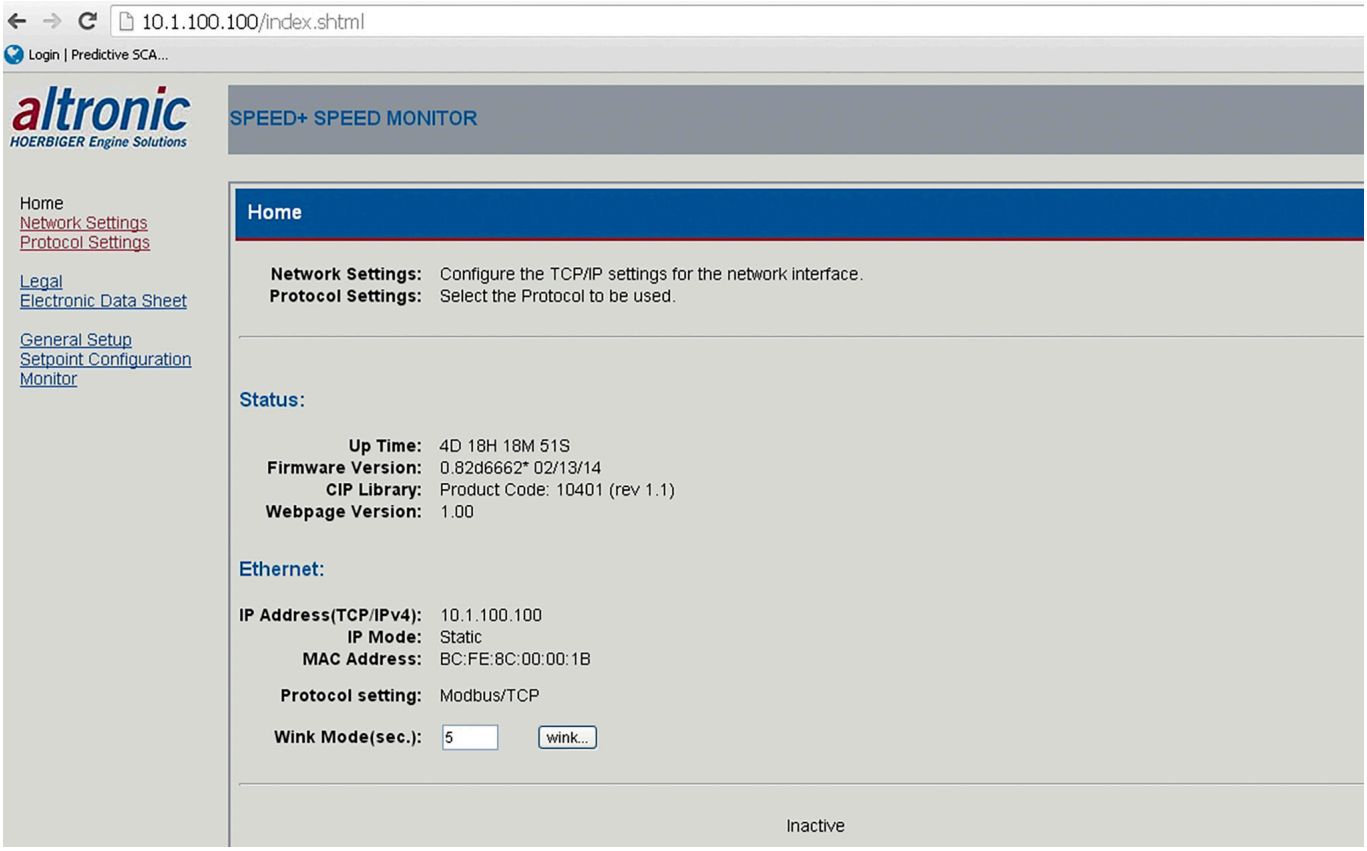
11.1 The Speed+ Monitor has a built-in web server that allows it to be set up. The embedded web server can be used to view and set the network settings, the protocol settings, and configure the Monitor. For connection details see wiring diagram at the end of this manual.

11.2 The PLC+ Monitors support Auto MDI/MDI-X crossover. A straight-through Ethernet cable may be used to connect the PC to the PLC+ Monitor. A straight-through connection through an Ethernet switch or hub on a network may also be used.

11.3 Once connected and powered, open your web browser and type the IP address assigned to the Monitor in the "Address" bar; http://10.1.100.100 for example. The Monitors home page will be displayed.

NOTE: The default parameters are:
Static IP Address: 10.1.100.100
Subnet Mask:255.255.255.0
Protocol Setting: EtherNet/IP

11.4 Home Page – The Home Page will show the current firmware version, Network Settings, Protocol Settings and allows execution of the “Wink” mode.



Default Settings are shown

Status:

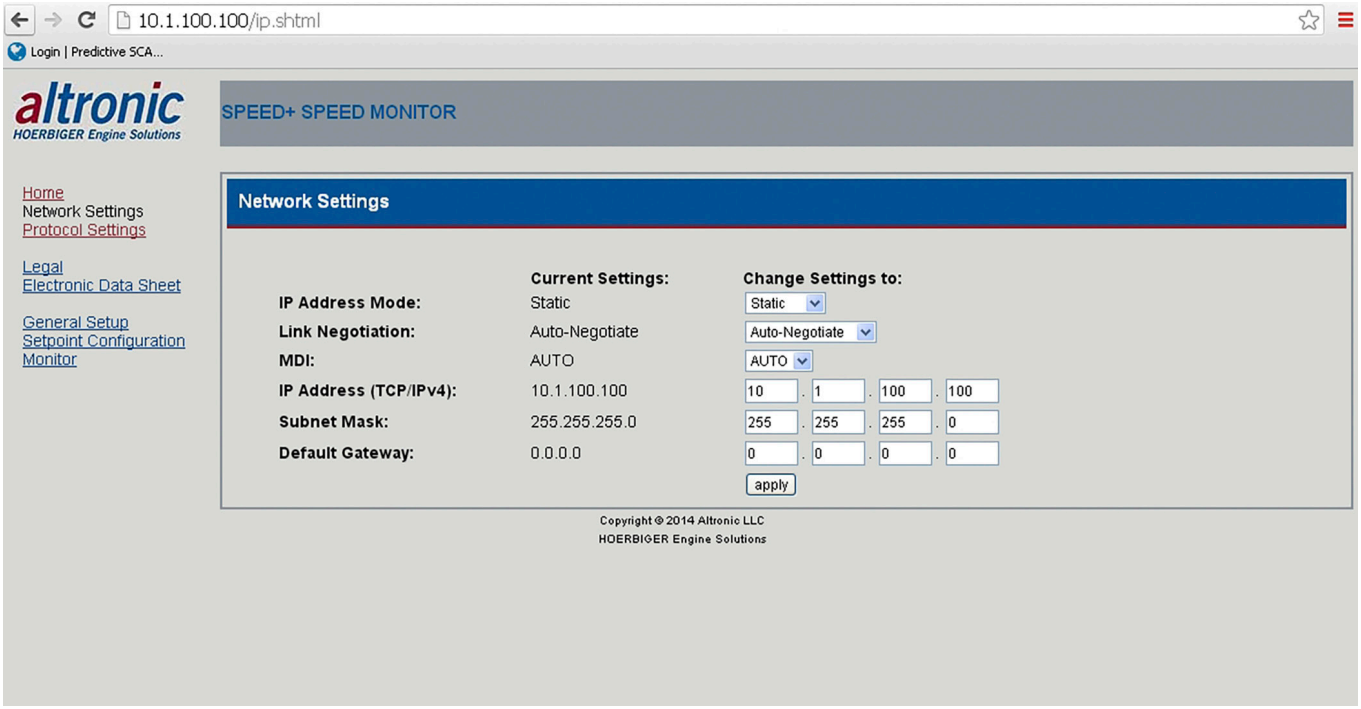
- Up Time – The Up Time is the time between power cycles.
- Firmware Version – The Firmware Version is the revision level and the date it was compiled
- CIP Library – The CIP Library is the personality code of the product and rev level.

Ethernet:

- IP Address – The IP Address is a node identification number for the device on the network. The current IP address is shown.
- IP Mode – IP Mode shows the current Static, DHCP, BootP, or AutoIP IP address assignment type.
- MAC Address – The MAC Address is the unique Hardware identifier of the Monitor assigned by the factory.
- Protocol Setting – Shows the current protocol; either EtherNet/IP or Modbus/TCP.
- Wink Mode – The “wink” mode is used to identify a Monitor in the network. When the wink mode is commanded the “STATUS” LED on the Monitor with the displayed IP address, will blink with short blinks at a rate of 1/8 second. This can be used by the integrator or technician to identify which unit is being talked to. The number of seconds the unit will “wink” for can be selected from 1 to 60 seconds.

12.0 Network Settings

12.1 Select the Network Settings page to change the network settings for this Monitor. Press the apply button to save the new settings. The following network settings can be selected.



Default settings are shown

IP Address Mode:

- Static – A Static IP Address is a fixed IP Address for the Monitor.
- DHCP, AutoIP, BOOTP – Dynamic Host Configuration Protocol (DHCP), link-local address (AutoIP), Bootstrap Protocol (BOOTP) are network discovery protocols that allow the Monitor to be automatically discovered on the network and be assigned the necessary information like an IP address, Subnet Mask, and Gateway by a server connected to the network to allow communication on the network.
- Link Negotiation – Auto-Negotiate, 100 Full Duplex, 100 Half Duplex, 10 Full Duplex, 10 Half Duplex. Auto negotiation chooses the highest performance transmission mode the network supports.
- MDI – A Medium Dependent Interface (MDI), Auto, MDI, MDI-X, is the physical and electrical selection. Auto detects if the connection would require a crossover connection and automatically selects for the correct connection.
- IP Address – The IP Address is an identification number assigned to a device. The PLC+ Monitors are set to a default IP address of 10.1.100.100 when received. See section 15.2 on how to return the IP address to the default setting.
- Subnet Mask – A Subnet Mask is used to distinguish between the host portion of the IP address and the network.
- Default Gateway – The Default Gateway is the node on the network that facilitates communication with other networks. The default gateway setting is optional. For networks that do not have a gateway, this should be set to 0.0.0.0.

12.2 DEFAULT NETWORK SETTINGS — The Speed+ Monitor is shipped with default network settings to allow the integrator to start at known settings. The following are the default Network Settings:

- IP Address Mode: Static
- Link Negotion: Auto-Negotiate
- MDI: Auto
- IP Address: 10.1.100.100
- Subnet Mask: 255.255.255.0
- Default Gateway: 0.0.0.0

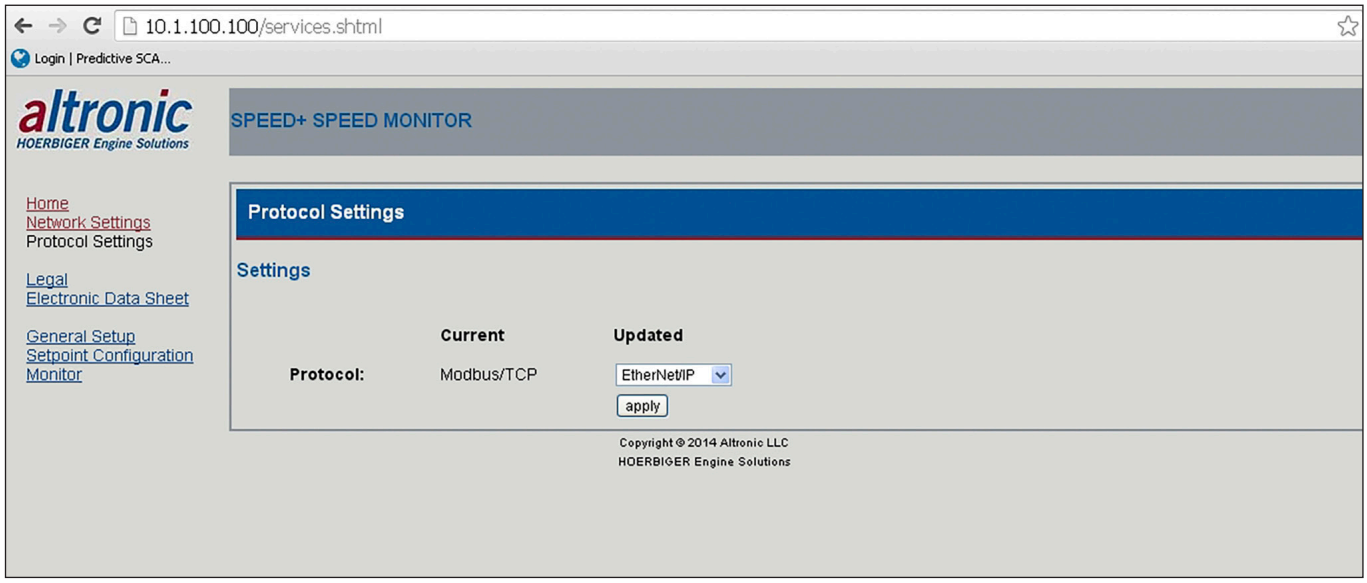
12.3 The Monitor can, at any time, be returned to the default network settings.

1. Power the Monitor
2. Locate the small hole on the bottom of the Monitor in line with the Ethernet connector.
3. Unwrap a paper clip. Insert the end into the hole to activate the reset switch. The switch has tactile feedback. Press and hold the switch on for 5 seconds.
4. Observe the Status LED indicator on the front panel; after a few seconds it will blink in rapid succession indicating the network settings have gone back to the default configuration.
5. Open your web browser and type the default IP address in the “Address” bar: http://10.1.100.100, the monitor home page will be displayed. The network settings on the PC may need to be reconfigured in order to communicate with the device.

13.0 Protocol Settings

13.1 Select the Protocol Settings page to change the protocol for this Monitor. The selections are EtherNet/IP or Modbus/TCP. Press the apply button to save the new settings.

NOTE: The Protocol setting is not affected by the reset switch and will remain the same.



14.0 Configuring the Speed Monitor

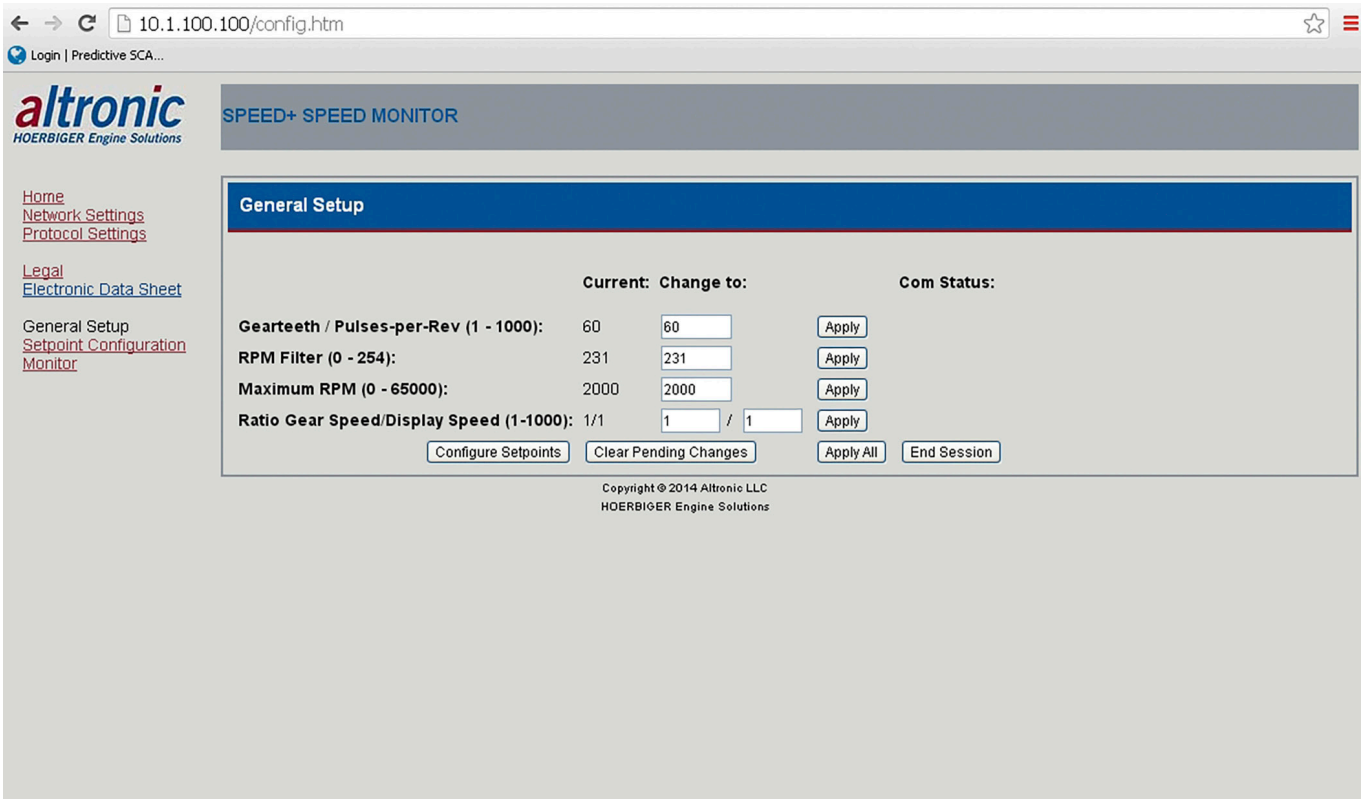
14.1 In addition to the network and protocol settings the Speed+ operating parameters can also be configured using the onboard web page. The web page is divided up by the following sections:

- General Setup
  - — Gearteeth
  - — RPM Filter
  - — Maximum RPM
  - — Ratio, Gear Speed to Display Speed
- Setpoint Configuration
  - — Setpoints (1-3)
  - — Current Loop
  - — Reset Input
  - — Output Switches (1 and 2)
- Monitor

To change a setting type the required value in the “Change to:” box. The line will highlight yellow. This indicates a change is pending. The yellow highlight will go away when “Apply” is selected indicating the new value is saved to the Monitor. The configuration parameters are described below. Each configuration parameter value must be carefully chosen.

NOTE: The Speed+ Speed Monitor must be configured prior to use.

15.0 General Setup Page



15.1 GEAR TEETH/PULSES-PER-REV

The gear teeth or pulses per revolution sets the number of pulses the Monitor is expected to see in one revolution. Set the PPR to 360 for a 360 tooth gear mounted on the crankshaft of an engine. The range is 1 to 1000.

15.2 RPM FILTER

The RPM filter is used to stabilize the RPM reading for a changing input. The filter is an adjustable dynamic software filter that can be set from 0 to 254. 0 being no filter, 254 being max filtering. A good starting filter value is 230.

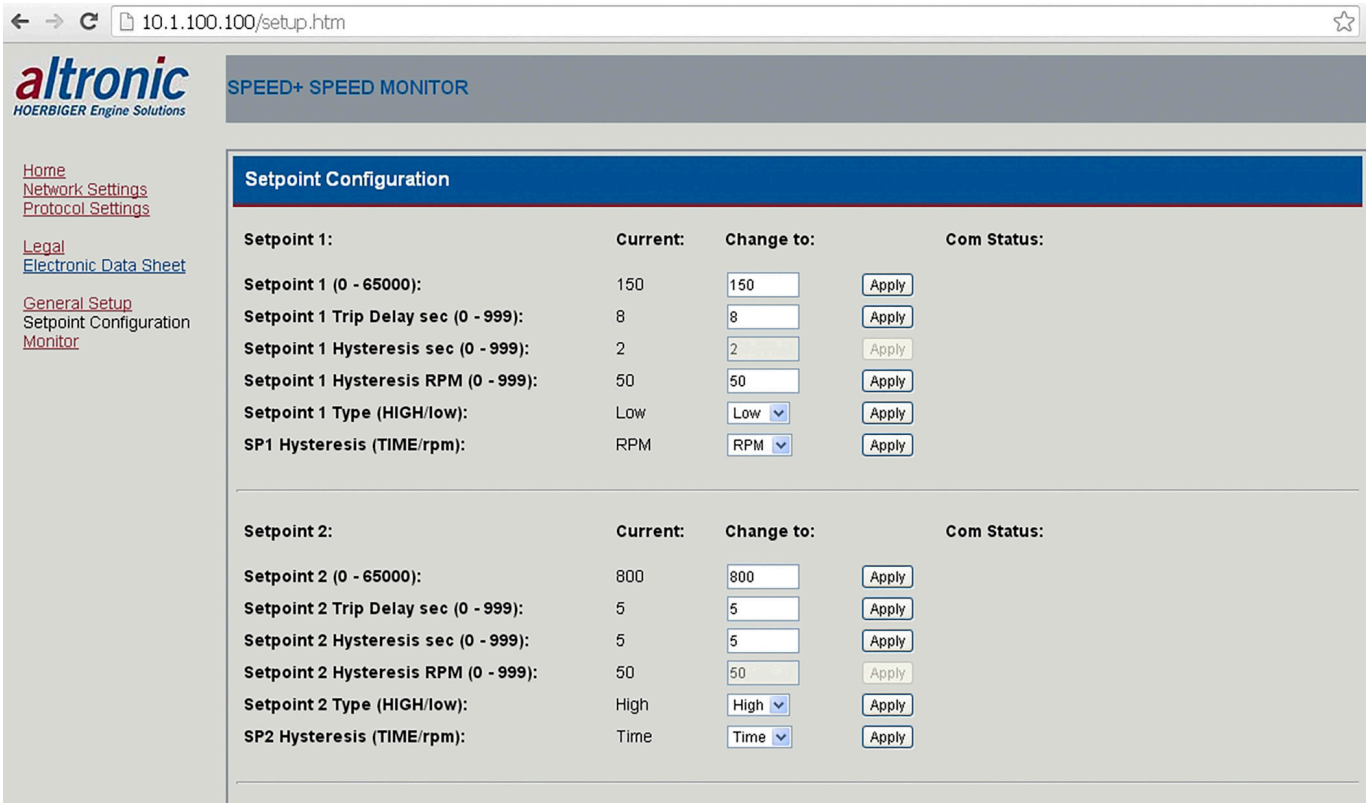
15.3 MAXIMUM SPEED

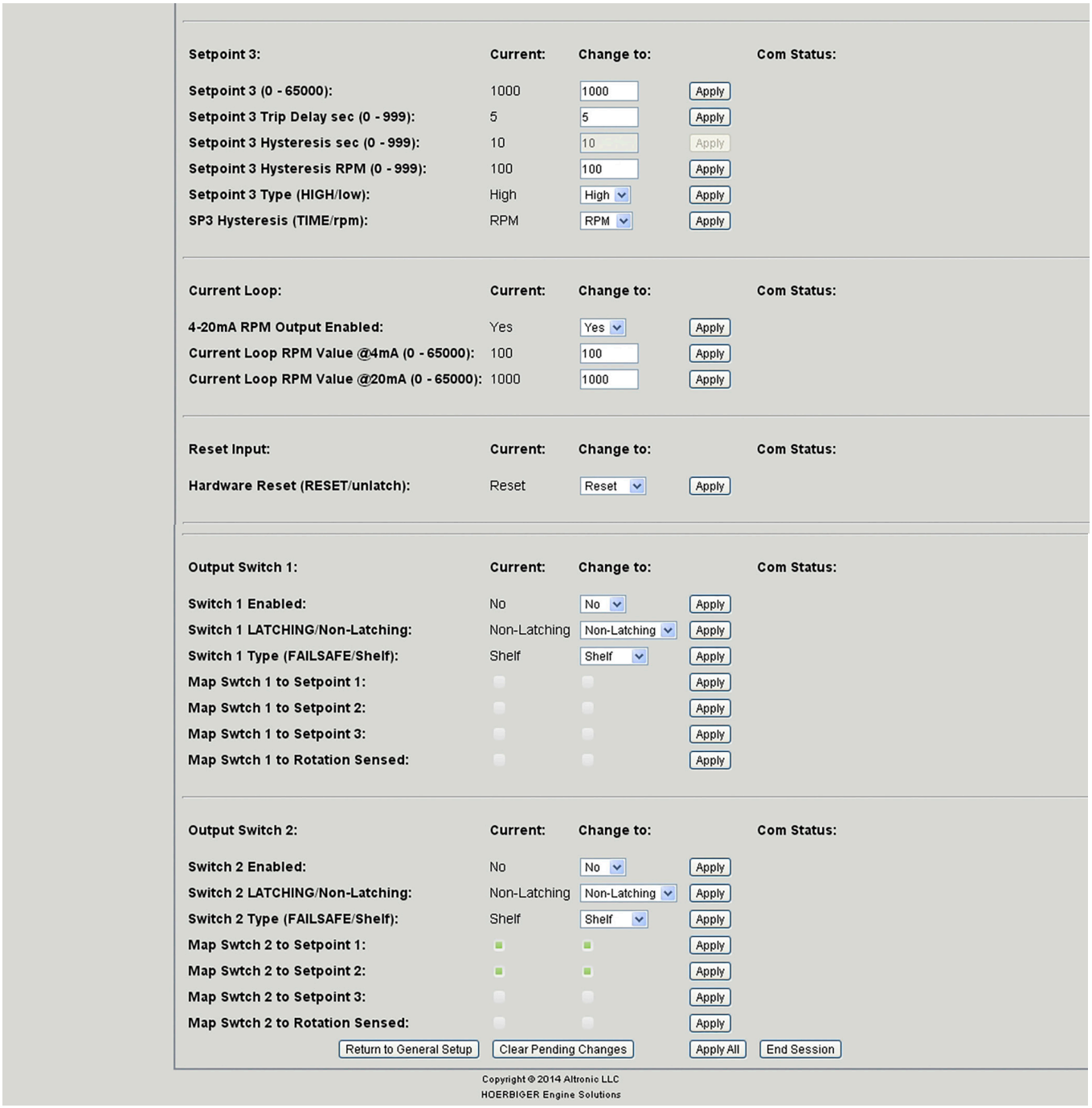
The Speed+ Monitor has a wide speed range (0–65000 rpm). The maximum speed configuration is used to zoom in on the desired range for the best resolution and accuracy. An example of this setting would be if the engine speed range is 0 to 1800 rpm the maximum speed setting should be set at 2000. If the speed range is up to 10,000 rpm the maximum speed setting should be set at 11,000 rpm. The Setpoints and current loop max speed value is limited by the maximum speed entered.

15.4 RATIO GEAR SPEED/DISPLAY SPEED

The input ratio is used to set the ratio of gear speed to display speed. When the input is from the crank shaft of the engine the ratio is 1 to 1. If the monitored gear is running 2 times the speed of interest (or display speed), then the ratio is 2 to 1. If the monitored gear is running 5 times slower than the speed of interest or display speed, then the ratio is 1 to 5. Although the input ratio is limited to whole numbers, virtually any ratio can be programmed by changing the ratio to whole numbers and entering the whole numbers. For example, a ratio of 1.67 to 1 would be entered as 167 to 100.

16.0 Setpoint Configuration





16.1 SETPOINTS (1-3)

There are three user configurable setpoints that can be set anywhere within 0 to Max speed as configured in the General Setup page. Each setpoint can be configured as a low or high setpoint. Each setpoint has a trip delay time, and a hysteresis value associated with it. The hysteresis can be set to either time in seconds or rpm. Note that the description below is for a high setpoint. If the hysteresis is set to time the rpm must stay below the setpoint for the entire time for the setpoint to clear. If hysteresis is set to rpm, the rpm will have to be met before the setpoint clears. So for example if the high setpoint is 800 rpm and the hysteresis is set for 50 rpm the setpoint would trigger at 800 rpm but will not clear until the rpm has fallen below 750 rpm.

16.2 CURRENT LOOP

The 4-20 mA current loop output allows the user to output a signal proportional to the RPM being measured and displayed. The current loop can be forward or reverse acting. The current loop range is 0 to Max speed as configured in the General Setup page.

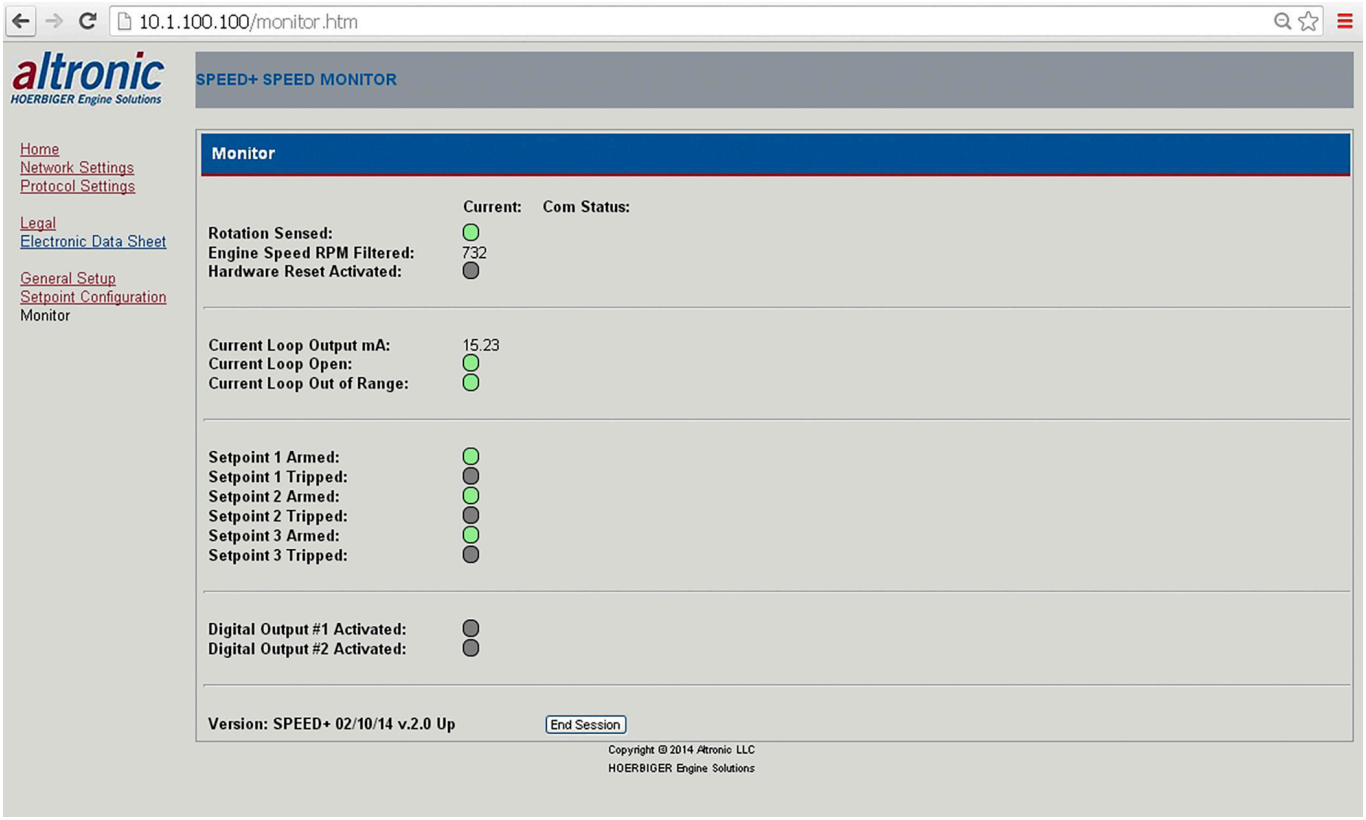
16.3 RESET INPUT

Remote reset is a configurable function. It can be configured to RESET or UNLATCH. When configured to RESET, and when grounded, the setpoints will go to their untripped state. Their associated timers will clear and start over. Both output switches, when set to latching, will be reset. When set to UNLATCH only the output switches when set to latching will be unlatched. Reset can be performed both by software and hardware. Modbus register 00016 is used for software reset. A hardware reset can be performed by momentarily grounding the RESET terminal on the front of the Monitor. It is an active low function with an internal pullup resistor. Note: The reset input is a one shot function internally and will not keep the Monitor in a reset state even if the Reset pin is continuously grounded. The reset will have to be released from ground for proper operation.

16.4 OUTPUT SWITCHES

There are two output switches, they can be used as speed trigger points, overspeed, underspeed, shutdown, alarms and many other speed related functions. Each switch can be mapped to any or all three setpoints as well as when rotation is sensed. Each switch can be set to be enabled or disabled, latching or non-latching, and shelf or failsafe. Shelf state is when the outputs are in the same condition with no faults as when unpowered; failsafe is when they are opposite. In non-latching mode, the output switch changes state when the setpoints come out of violation; in latching mode, a reset event is required to clear the switches from the tripped state. Unpowered states for the switches are closed for SW 1 and open for SW 2.

17.0 Monitor



17.1 The Monitor mode can be used to view the status of the Speed+. Indicators under the "Current" column show the status for each function. "Com Status" will show "updating..." when data is being updated.

The definition of each indicator is as follows:
Gray — not active or below setpoint
Green — active or occurring
Yellow — alarm or caution
Red — fault or shutdown

The following functions and their conditions can be viewed.

17.2 ROTATION SENSED
Indicates when the speed input senses rotation.

17.3 ENGINE SPEED
Shows the current speed.

17.4 HARDWARE RESET ACTIVE
Indicates when the reset pin is grounded.

17.5 CURRENT LOOP Ma
Shows the output current loop value in milliamps.

17.6 CURRENT LOOP OPEN
Indicates if the current loop wire is broken or disconnected.

17.7 CURRENT LOOP OUT OF RANGE
Indicates if the current loop is below 2mA or above 22 mA

17.8 SETPOINT 1-3 ARMED
Each setpoint if set to low has to be above its setpoint value plus the hysteresis value before it is armed. If it is set for high the setpoint is armed upon sensing rotation.

17.9 SETPOINT 1-3 TRIPPED
Indicates when the setpoint is above the setpoint value when set to high and below the setpoint value when set to low.

17.10 DIGITAL OUTPUT #1, #2 ACTIVATED
Indicates when the output switch is activated.

18.0 EtherNet/IP and Modbus/TCP

18.1 The Speed+ Speed Monitor is part of a system designed to easily interface to popular PLCs, SCADA systems and computers. The Speed+ has two user-selectable communication protocols, EtherNet/IP and Modbus/TCP. The built-in WEB SERVER is used to select the protocol. See section 12.0 EMBEDDED WEB SERVER to select the protocol.

18.2 EtherNet/IP – Ethernet Industrial Protocol is Ethernet combined with an industrial application layer protocol targeted to industrial PLCs. The EtherNet/IP protocol is used by Allen Bradley in their Compact Logix and Control Logix PLCs. The EtherNet/IP is used in many other PLC manufacturers as well.

18.3 The data for EtherNet/IP is arranged as a collection of objects. Objects divide the functionality of a device into logically related subsets. This collection of related data values and common elements of the device make up its object model.

19.0 EtherNet/IP Object Models

19.1 The following Objects are used in the Speed+.

OBJECT (ID)	TYPE
Identity (01h)	Required
Message Router (02h)	Required
Assembly (04h)	Device-specific
Connection Manager (06h)	Required
TCP Object (F5h)	Required
Ethernet Link Object (F6h)	Required
QoS (48h)	Pre-defined
Parameter (0Fh)	Pre-defined
Parameter Group (10h)	Pre-defined
Group (12h)	Pre-defined
File (37h)	Pre-defined
Speed (70h)	Vendor Specific

19.2 **Identity Object (01h – 1 instance)**
The identity object provides identification of, and general information about, the Speed+.

ATTR ID	NAME	DATA TYPE	DATA VALUE	Access RULE
Class Attributes				
1	Revision	UINT	1	GET
Instance Attributes				
1	Vendor Number	UINT	1250_{DEC}	GET
2	Device Type, Generic	UINT	$2b_{HEX}$	GET
3	Product Code Number	UINT	$27DA_{HEX}$	GET
4	Product Major Revision Product Minor Revision	USINT USINT	02 30	GET
5	Status Word (see definition below)	WORD	See Below	GET
6	Product Serial Number (unit mac address)	UDINT	Unique 32 Bit Val	GET
7	Product Name **Structure of:** Product Name Size Product Name String	 USINT USINT[0-32]	 7 “SpeedPlus”	GET

Status Word		
Bit	**Bit = 0**	**Bit = 1**
0	No I/O Connection	I/O Connection Allocated
1-15	Unused	Unused

Common Services

SVC CODE	IMPLEMENTED FOR		SERVICE NAME
	CLASS LEVEL	INSTANCE LEVEL	
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
05_{HEX}	No	Yes	Reset

Chart continues…)

Reset Service Code

SVC CODE	CLASS	INSTANCE	DATA[1]	DESCRIPTION
05h	01h	01h	00h	Force software reset.
05h	01h	01h	01h	Reload factory settings and reset.

[1] This device requires that the attribute be left blank and that the valve be entered in the data field.

19.3 Message Router Object (02h)

The message router object provides a messaging connection point through which a client may address a service to any object class or instance residing in the Speed+.

The Speed+ has no supported attributes.

19.4 Assembly Object (04h)

The Assembly Object binds attributes of multiple objects, which allows data to or from each object to be sent or received over a single connection. Assembly objects can be used to bind input data or output data. The terms "input" and "output" are defined from the network's point of view. An input will produce data on the network and an output will consume data from the network.

ATTR ID	NAME	DATA TYPE	DATA VALUE	ACCESS RULE
Class Attributes				
1	Revision	UINT	1	GET
2	Max Instance	UINT	255	GET
Instance 64H Attributes (Input Instance 1)				
3	Input Data (T->O)	INT[12]	See below	GET
Instance 65H Attributes (Output Instance 1)				
3	Output Data (O->T)	INT[4]	See below	SET
Instance 66H Attributes (Configuration Instance)				
3	Configuration (CFG)	SINT[48]	See below	SET
Instance FDH Attributes (Output Only Instance)				
This instance allows clients to produce output data without monitoring the input data.				
Instance FEH Attributes (Input only Instance)				
This instance allows clients to control the input without providing output data.				
Instance FFH Attributes (Heartbeat Instance – Listen Only)				
This instance allows clients to monitor input data without providing output data.				

Common Services

SVC CODE	IMPLEMENTED FOR		
	CLASS LEVEL	INSTANCE LEVEL	SERVICE NAME
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
05_{HEX}	No	Yes	Reset

19.5 Input Assembly Data "Target to Originator" (T->O)

INDEX	NAME	EQUIV MODBUS REGISTER
0.0	SW1 Enabled	00017
0.1	SW1 Latching	00018
0.2	SW1 Failsafe	00019
0.3	Map SW1 to SP1	00020
0.4	Map SW1 to SP2	00021
0.5	Map SW1 to SP3	00022
0.6	Map SW1 to Rotation Sensed	00023
0.7	Reserved	00024
0.8	SW1 Enabled	00025
0.9	SW1 Latching	00026
0.10	SW1 Failsafe	00027
0.11	Map SW1 to SP1	00028
0.12	Map SW1 to SP2	00029
0.13	Map SW1 to SP3	00030
0.14	Map SW1 to Rotation Sensed	00031
0.15	Setpoints Lock-Out	00032
1.0	Reserved	10017
1.1	Reset In	10018
1.2	Current Loop Fault	10019
1.3	Setpoints Active	10020
1.4	RPM Low Tripped	10021
1.5	RPM High Tripped	10022
1.6	RPM Hi-Hi Tripped	10023
1.7	Engine Rotating	10024
1.8	Digital Out 1 Active	10025
1.9	Digital Out 2 Active	10026
1.10	Current Loop Output out of Range	10027
1.11	RPM Low Now	10028
1.12	RPM High Now	10029
1.13	RPM Hi-Hi Now	10030
1.14	Reserved	10031
1.15	Supply Voltage out of Range	10032
2	Reserved1 (Echo)	40065
3	Current Loop Output Value (*100)	30011
4	Speed (Instantateous) [1]	30008
5		
6	Acceleration	30006
7	24V Reading (*100)	30013
8	Speed [2]	30007
9		
10	Communication Status Register	***
11	Reserved2 (Echo)	***

[1] Actual value is a REAL and can be copied to a corresponding UDT
[2] Actual value is a DINT and can be copied to a corresponding UDT

19.6 Output Assembly Data "Originator to Target" (O->T)

INDEX	NAME	MIN	MAX	DEFAULT	EQUIV MODBUS REG
0.0	SW1 Enabled	0	1	0	00017
0.1	SW1 Latching	0	1	0	00018
0.2	SW1 Failsafe	0	1	0	00019
0.3	Map SW1 to SP1	0	1	0	00020
0.4	Map SW1 to SP2	0	1	0	00021
0.5	Map SW1 to SP3	0	1	0	00022
0.6	Map SW1 to Rotation Sensed	0	1	0	00023
0.7	Reserved	0	1	0	00024
0.8	SW1 Enabled	0	1	0	00025
0.9	SW1 Latching	0	1	0	00026
0.10	SW1 Failsafe	0	1	0	00027
0.11	Map SW1 to SP1	0	1	0	00028
0.12	Map SW1 to SP2	0	1	0	00029
0.13	Map SW1 to SP3	0	1	0	00030
0.14	Map SW1 to Rotation Sensed	0	1	0	00031
0.15	Setpoints Lock-Out	0	1	0	00032
1	Reserved1	-32768	32767	0	40013
2	Status Control	-32768	32767	0	40065
3	Reserved2	-32768	32767	0	***

19.7 Configuration Assembly Data

INDEX	NAME	MIN	MAX	DEFAULT	EQUIV MODBUS REG
0.0 thru 0.7	Reserved (Bits)			0	00001 thru 00008
1.0	SP1 Type High			0	00009
1.1	SP2 Type High			0	00010
1.2	SP3 Type High			0	00011
1.3	SP1 Hysteresis Time			0	00012
1.4	SP2 Hysteresis Time			0	00013
1.5	SP3 Hysteresis Time			0	00014
1.6	4-20mA RPM Output Enable			0	00015
1.7	Hardware Reset Reset			0	00016
2	Reserved	-32768	32768	0	n/a
3					
4	Gear Ratio [1,3]	>0	1000	1	40045/40046
5					
6					
7					
8	Gear Teeth [3]	1	1000	360	40009
9					

INDEX	NAME	MIN	MAX	DEFAULT	EQUIV MODBUS REG
10	Filter Weight	0	254	0	40005
11					
12	Maximum RPM [1,3]	0	65000	1000	40008
13					
14					
15					
16	RPM @ 20mA Current Loop Output [2]	0	65000	65000	40035
17					
18					
19					
20	RPM @ 4mA Current Loop Output [2]	0	65000	0	40034
21					
22					
23					
24	Setoint 1 Hysteresis	0	999	0	40015/40016
25					
26	Setpoint 1 Trip Delay	0	999	0	40014
27					
28	Setpoint 1 [2]	0	Maximum RPM	0	40013
29					
30					
31					
32	Setpoint 2 Hysteresis	0	999	0	40019/40020
33					
34	Setpoint 2 Trip Delay 3	0	999	0	40018
35					
36	Setpoint 2 [2]	0	Maximum RPM	0	40017
37					
38					
39					
40	Setpoint 3 Hysteresis	0	999	0	40023/40024
41					
42	Setpoint 3 Trip Delay	0	999	0	40022
43					
44	Setpoint 3 [2]	0	Maximum RPM	0	40021
45					
46					
47					

Actual values are INT unless otherwise specified and can be copied to a corresponding UDT

[1] Actual value is a REAL and can be copied to a corresponding UDT

[2] Actual value is a DINT and can be copied to a corresponding UDT

[3] This can't be sent while engine is rotating

19.8 **Connection Manager Object (06h)**
This object is used for connection and connectionless communication, including establishing connections across multiple subnets.

19.9 **TCP/IP Interface Object (F5h – 1 instance)**
The TCP/IP Interface Object provides the mechanism to configure a device's TCP/IP network interface. Examples of configurable items include the device's IP Address, Network Mask, and Gateway Address.

ATTR ID	NAME	DATA TYPE	DATA VALUE	Access RULE
Class Attributes				
1	Revision	UINT	1	GET
Instance Attributes				
1	Status[1]	DWORD	1	GET
2	Configuration Capability[2]	UINT[]	5	GET
3	Configuration Control[3]		0	GET
4	Physical Link Object[4]-			GET
	A Structure of:			
	Path Size	UINT	2	
	Path	Array of WORD	20F6H.. 2401H	
5	Interface Configuration[5]			GET
	A Structure of:			
	IP Address	UDINT	0	
	Network Mask	UDINT	0	
	Gateway Address	UDINT	0	
	Name Server	UDINT	0	
	Name Server 2	UDINT	0	
	Domain Name Size	UINT	0	
	Domain Name	STRING	0	
6	Host Name[6]			GET
	A Structure of:			
	Host Name Size	UINT	0	
	Host Name	STRING	0	

Common Services

SVC CODE	IMPLEMENTED FOR		SERVICE NAME
	CLASS LEVEL	INSTANCE LEVEL	
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
10_{HEX}	No	Yes	Set_Attribute_Single

[1] See section 5-3.2.2.1 of "Volume 2: EtherNet/IP Adaptation of CIP™" from ODVA for more details on this attribute.
[2] See section 5-3.2.2.2 of "Volume 2: EtherNet/IP Adaptation of CIP™" from ODVA for more details on this attribute.
[3] See section 5-3.2.2.3 of "Volume 2: EtherNet/IP Adaptation of CIP™" from ODVA for more details on this attribute.
[4] See section 5-3.2.2.4 of "Volume 2: EtherNet/IP Adaptation of CIP™" from ODVA for more details on this attribute.
[5] See section 5-3.2.2.5 of "Volume 2: EtherNet/IP Adaptation of CIP™" from ODVA for more details on this attribute.
[6] See section 5-3.2.2.6 of "Volume 2: EtherNet/IP Adaptation of CIP™" from ODVA for more details on this attribute.

19.10 **EtherNet Link Object (F6h – 1 instance)**
The Ethernet Link Object maintains link-specific counters and status information for an IEEE 802.3 communications interface.

ATTR ID	NAME	DATA TYPE	DATA VALUE	ACCESS RULE
Class Attributes				
1	Revision	UINT	1	GET
Instance Attributes				
1	Interface Speed[1]	UDINT	100 (default)	GET
2	Interface Flags[2]	DWORD	3 (default)	GET
3	Physical Address[3]	USINT Array[6]	0 default)	GET

Common Services			
SVC CODE	IMPLEMENTED FOR		
	CLASS LEVEL	INSTANCE LEVEL	SERVICE NAME
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single

[1] See section 5-4.2.2.2 of "Volume 2: EtherNet/IP Adaptation of CIP™" from ODVA for more details on this attribute.
[2] See section 5-4.2.2.1 of "Volume 2: EtherNet/IP Adaptation of CIP™" from ODVA for more details on this attribute.
[3] See section 5-4.2.2.3 of "Volume 2: EtherNet/IP Adaptation of CIP™" from ODVA for more details on this attribute.

19.11 **QoS Object (48h – 1 instance)**
The QoS Object provides a means to configure certain QoS-related behaviors in EtherNet/IP devices.

ATTR ID	NAME	DATA TYPE	DATA VALUE	ACCESS RULE
Class Attributes				
1	Revision	UINT	1	GET
Instance Attributes				
4	DSCP Urgent	USINT	[1]	GET/SET
5	DSCP Scheduled	USINT	[1]	GET/SET
6	DSCP High	USINT	[1]	GET/SET
7	DSCP Low	USINT	[1]	GET/SET
8	DSCP Explicit	USINT	[1]	GET/SET

Common Services			
SVC CODE	IMPLEMENTED FOR		
	CLASS LEVEL	INSTANCE LEVEL	SERVICE NAME
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
10_{HEX}	No	Yes	Get_Attribute_Single

[1] See section 5-6.4.2 of "Volume 2: EtherNet/IP Adaptation of CIP™" from ODVA for more details on these attributes.

19.12 **Parameter Object (OFh – 208 instances)**

The parameter object along with the parameter group and group objects provide an alternate path to the data provided by the vendor specific objects: “Sensor”, “Speed”, and “Log”.

ATTR ID	NAME	DATA TYPE	DATA VALUE	ACCESS RULE
Class Attributes				
1	Revision	UINT	1	GET
2	Max Instance ID	UINT	30	GET
3	Number of Instances	UINT	30	GET
4	Attribute List	UINT,UINT[]	15,[7-21]	GET
5	Service List	UINT,UINT[]	1,[1]	GET
6	Max Object Attribute ID	UINT	9	GET
7	Max Instance Attribute ID	UINT	21	GET
8	Parameter Class Descriptor	WORD	0000000000001011b	GET
9	Configuration Assembly Instance	UINT	0	GET
Instance Attributes				
1	Parameter Value	[data type]	See Tables below	GET/SET
2	Link Path Size	USINT		GET
3	Link Path	Packed EPATH		GET
4	Descriptor	WORD	[1]	GET
5	Data Type	USINT	Refer to referenced data	GET
6	Data Size	USINT		GET
7	Parameter Name String	SHORT_STRING	*Same as “Tag” for referenced item*	GET
8	Units String	SHORT_STRING	*Same as “Tag” for referenced item*	GET
9	Help String	SHORT_STRING	*Same as Get_Label service for referenced item*	GET
10	Minimum Value	[data type]	Refer to referenced data	GET
11	Maximum Value	[data type]		GET
12	Default Value	[data type]		GET
13	Scaling Multiplier	UINT	1	GET
14	Scaling Divisor	UINT	1	GET
15	Scaling Base	UINT	1	GET
16	Scaling Offset	INT	0	GET
17	Multiplier Link	UINT	0	GET
18	Divisor Link	UINT	0	GET
19	Base Link	UINT	0	GET
20	Offset Link	UINT	0	GET
21	Decimal Precision	USINT	0	GET

Common Services

SVC CODE	IMPLEMENTED FOR		SERVICE NAME
	CLASS LEVEL	INSTANCE LEVEL	
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
10_{HEX}	No	Yes	Get_Attribute_Single
01_{HEX}	No	Yes	Get_Attribute_All

19.13 **"Speed" Object Parameter Mapping (Group Instance 1)**
Instance (Parameter Group Instance)

Attribute	1 (1)	Attribute	1 (1)
1	1	16	16
2	2	17	17
3	3	18	18
4	4	19	19
5	5	20	20
6	6	21	21
7	7	22	22
8	8	23	23
9	9	24	24
10	10	25	25
11	11	26	26
12	12	27	27
13	13	28	28
14	14	29	29
15	15	30	30

19.14 **Parameter Group Object (10h – 41 instances)**
The parameter object along with the parameter group and group objects provide an alternate path to the data provided by the vendor specific objects: "Sensor", "Speed", and "Log".

ATTR ID	NAME	DATA TYPE	DATA VALUE	ACCESS RULE
Class Attributes				
1	Revision	UINT	1	GET
2	Max Instance ID	UINT	1	GET
3	Number of Instances	UINT	1	GET
4	Attribute List	UINT,UINT[]	0	GET
5	Service List	UINT,UINT[]	1,[1]	GET
6	Max Object Attribute ID	UINT	6	GET
Instance Attributes				
1	Group Name String	SHORT_STRING	Object name and instance index if applicable: "sensor[2]" or "speed"	GET
2	Number of members in group	UINT	Refer to tables above	GET
3	Parameter Instance of first member	UINT		GET
4-n	Parameter Instance of n^{th} member	UINT		GET

Common Services

SVC CODE	IMPLEMENTED FOR		
	CLASS LEVEL	INSTANCE LEVEL	SERVICE NAME
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
01_{HEX}	No	Yes	Get_Attribute_All

19.15 **Group Object (12h – 2 instances)**

The parameter object along with the parameter group and group objects provide an alternate path to the data provided by the vendor specific objects: “Sensor”, “Speed”, and “Log”.

ATTR ID	NAME	DATA TYPE	DATA VALUE	ACCESS RULE
Class Attributes				
1	Revision	UINT	1	GET
2	Max Instance ID	UINT	1	GET
3	Number of Instances	UINT	1	GET
4	Attribute List	UINT,UINT[]	6,[1-4,6-7]	GET
5	Service List	UINT,UINT[]	1,[1]	GET
6	Max Object Attribute ID	UINT	7	GET
7	Max Instance Attribute ID	UINT	7	GET
Instance Attributes				
1	Number of Attributes	USINT	See tables above	GET
2	Attribute List	USINT[]		GET
3	Number of bound instances	USINT		GET
4	Binding	Array of: UINT: Class ID UINT: Instance ID		GET
6	Owner Vendor ID	UINT	1250	GET
7	Owner – Serial Number	UDINT	This device’s serial number (see Identity Object)	GET

Common Services

SVC CODE	IMPLEMENTED FOR		SERVICE NAME
	CLASS LEVEL	INSTANCE LEVEL	
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
01_{HEX}	No	Yes	Get_Attribute_All

19.16 **File Object (37h – 2 instances)**

The file object allows easy access to the device EDS and icon files from within a PLC control environment.

ATTR ID	NAME	DATA TYPE	DATA VALUE	ACCESS RULE
Class Attributes				
1	Revision	UINT	1	GET
2	Max Instance ID	UINT	201	GET
3	Number of Instances	UINT	2	GET
4	Attribute List	UINT,UINT[]	1,[11]	GET
5	Service List	UINT,UINT[]	1,[77]	GET
6	Max Object Attribute ID	UINT	32	GET
7	Max Instance Attribute ID	UINT	11	GET
32	Directory	Array of: UINT: Instance Number STRINGI: Instance_Name STRINGI: File_Name	[{200, (ENG)”EDS and Icon Files”, (ENG)“EDS.txt”}, {201, (ENG)“Related EDS and Icon Files”, (ENG)“EDSCollection.gz”}]	GET

ATTR ID	NAME	DATA TYPE	DATA VALUE	ACCESS RULE
Instance C8H Attributes (EDS file)				
1	State[2]	USINT	2 (Default – Loaded)	GET
2	Instance Name	STRINGI	(ENG)"EDS and Icon Files"	GET
3	Instance Format Version	UINT	1	GET
4	File Name	STRINGI	(ENG)"EDS.txt"	GET
5	File Revision	USINT: Major_Revision USINT: Minor_Revision	0[1] 3	GET
6	File Size	UDINT	8292[1]	GET
7	File Checksum	INT	-20137[1]	GET
8	Invocation Method	USINT	255	GET
9	File Save Parameters	BYTE	00000000b	GET
10	File Type[3]	USINT	1	GET
11	File Encoding Format[4]	USINT	0	GET
Instance C9H Attributes (Icon file)				
1	State[2]	USINT	2 (Default – Loaded)	GET
2	Instance Name	STRINGI	(ENG)"Related EDS and Icon Files"	GET
3	Instance Format Version	UINT	1	GET
4	File Name	STRINGI	(ENG)"EDSCollection.gz"	GET
5	File Revision	USINT: Major_Revision USINT: Minor_Revision	0[1] 8	GET
6	File Size	UDINT	433[1]	GET
7	File Checksum	INT	10478[1]	GET
8	Invocation Method	USINT	255	GET
9	File Save Parameters	BYTE	00000000b	GET
10	File Type[3]	USINT	1	GET
11	File Encoding Format[4]	USINT	1 (compressed)	GET

Common Services

SVC CODE	IMPLEMENTED FOR		
	CLASS LEVEL	INSTANCE LEVEL	SERVICE NAME
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
01_{HEX}	No	Yes	Get_Attribute_All
$4B_{HEX}$	No	Yes	Init_Upload
$4D_{HEX}$	No	Yes	Init_Partial_Read
$4F_{HEX}$	No	Yes	Upload

[1] These values are subject to change without notice.
[2] See section 5-42.2 of "Volume 2: EtherNet/IP Adaptation of CIP™" from ODVA for more details on this attribute.
[3] See section 5-42.2 of "Volume 2: EtherNet/IP Adaptation of CIP™" from ODVA for more details on this attribute.
[4] See section 5-42.8 of "Volume 2: EtherNet/IP Adaptation of CIP™" from ODVA for more details on this attribute.

19.17 **Speed Object (70h – 1 instance)**
The Speed Object gives access to the configuration and run-time parameters.

ATTR ID	NAME	DATA TYPE	DATA VALUE (MIN)	DATA VALUE (MAX)	ACCESS RULE
Class Attributes					
1	Revision	UINT	1		GET
2	Max Instance ID	UINT	1		GET
3	Number of Instances	UINT	1		GET
4	Attribute List	UINT,UINT[]	18,[1-18]		GET
5	Service List	UINT,UINT[]	5,[14,16,1,2,76]		GET
6	Max Object Attribute ID	UINT	7		GET
7	Max Instance Attribute ID	UINT	32		GET
Instance Attributes					
1	Setpoint 1 Type	BOOL	0	1	GET/SET
2	Setpoint 2 Type	BOOL	0	1	GET/SET
3	Setpoint 3 Type	BOOL	0	1	GET/SET
4	Setpoint 1 Hysteresis Type	BOOL	0	1	GET/SET
5	Setpoint 2 Hysteresis Type	BOOL	0	1	GET/SET
6	Setpoint 3 Hysteresis Type	BOOL	0	1	GET/SET
7	Current Loop Enabled	BOOL	0	1	GET/SET
8	Hardware Reset Type	BOOL	0	1	GET/SET
9	Switch 1 Enable	BOOL	0	1	GET/SET
10	Switch 1 Latching	BOOL	0	1	GET/SET
11	Switch 1 Failsafe	BOOL	0	1	GET/SET
12	Switch 1 Map to SP1	BOOL	0	1	GET/SET
13	Switch 1 Map to SP2	BOOL	0	1	GET/SET
14	Switch 1 Map to SP3	BOOL	0	1	GET/SET
15	Switch 1 on Rotation Sensed	BOOL	0	1	GET/SET
16	Switch 2 Enable	BOOL	0	1	GET/SET
17	Switch 2 Latching	BOOL	0	1	GET/SET
18	Switch 2 Failsafe	BOOL	0	1	GET/SET
19	Switch 2 Map to SP1	BOOL	0	1	GET/SET
20	Switch 2 Map to SP2	BOOL	0	1	GET/SET
21	Switch 2 Map to SP3	BOOL	0	1	GET/SET
22	Switch 2 on Rotation Sensed	BOOL	0	1	GET/SET
23	Setpoint Lockout	BOOL	0	1	GET/SET
24	Gear Ratio	REAL	>0	1000	GET/SET
25	Gearteeth	INT	1	1000	GET/SET
26	RPM Filter	INT	0	254	GET/SET
27	Max RPM	UINT	0	65000	GET/SET
28	RPM @ 20mA Output	UINT	0	65000	GET/SET
29	RPM @ 4mA Output	UINT	0	65000	GET/SET

ATTR ID	NAME	DATA TYPE	DATA VALUE (MIN)	DATA VALUE (MAX)	ACCESS RULE
30	Setpoint 1 Hysteresis	INT	0	999	GET/SET
31	Setpoint 1 Trip Delay	INT	0	999	GET/SET
32	Setpoint 1	UINT	0	65000	GET/SET
33	Setpoint 2 Hysteresis	INT	0	999	GET/SET
34	Setpoint 2 Trip Delay	INT	0	999	GET/SET
35	Setpoint 2	UINT	0	65000	GET/SET
36	Setpoint 3 Hysteresis	INT	0	999	GET/SET
37	Setpoint 3 Trip Delay	INT	0	999	GET/SET
38	Setpoint 3	UINT	0	65000	GET/SET

Common Services

SVC CODE	IMPLEMENTED FOR		SERVICE NAME
	CLASS LEVEL	INSTANCE LEVEL	
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
10_{HEX}	No	Yes	Set_Attribute_Single
01_{HEX}	No	Yes	Get_Attribute_All
02_{HEX}	No	Yes	Set_Attribute_All
$4C_{HEX}$	No	Yes	Get_Label

Service Description for "Get_Label" (4CH)
The "Get_Label" service provides a simple, human readable, description of the data point in question. This service is roughly equivalent to the "Read Label (fn 101, 102, 103, and 104)" service available through Modbus. The request must specify the Attribute ID for which the label is to be read and returns a STRINGI containing the label.

Service Description for "Key_Command" (4BH)
The "Key_Command" service provides a method for sending discrete commands to the module. These commands can be used to reset the device state machine, clear, or acknowledge alarms. It provides easy access to anything that requires momentary or event based access. This service provides similar access to the device as the 40255 and 40256 Modbus registers. When using this service, the attribute should be omitted. The message payload is an array as follows:

Index	Data	Data Type
0	Key Command Number	SINT
1	Key Command Compliment[1]	SINT
2	Key Command Argument 1	SINT
3	Key Command Argument 2	SINT

[1] This value is a bitwise inversion of index 0

20.0 Modbus/TCP

Modbus/TCP is Modbus over Ethernet. The registers are listed below.

Location	Label	0	1	Default
Read/Write bits				
00000's	Global Functions			
00001 thru 00008	Reserved			0
00009	Setpoint 1 Type (HIGH/low)	low	HIGH	0
00010	Setpoint 2 Type (HIGH/low)	low	HIGH	0
00011	Setpoint 3 Type (HIGH/low)	low	HIGH	0
00012	SP1 Hysteresis (TIME/rpm)	rpm	TIME	0
00013	SP2 Hysteresis (TIME/rpm)	rpm	TIME	0
00014	SP3 Hysteresis (TIME/rpm)	rpm	TIME	0
00015	4-20mA RPM Output Enabled	no	yes	0
00016	Hardware Reset (RESET/unlatch)	unlatch	RESET	0
00017	Switch 1 Enabled	no	yes	0
00018	Switch 1 LATCHING/Non-Latching	Non-Latching	LATCHING	0
00019	Switch 1 Type (FAILSAFE/Shelf)	Shelf	FAILSAFE	0
00020	Map Swtch 1 to Setpoint 1	no	yes	0
00021	Map Swtch 1 to Setpoint 2	no	yes	0
00022	Map Swtch 1 to Setpoint 3	no	yes	0
00023	Map Swtch 1 to Rotation Sensed	no	yes	0
00024	RESERVED			0
00025	Switch 2 Enabled	no	yes	0
00026	Switch 2 LATCHING/Non-Latching	Non-Latching	LATCHING	0
00027	Switch 2 Type (FAILSAFE/Shelf)	Shelf	FAILSAFE	0
00028	Map Swtch 2 to Setpoint 1	no	yes	0
00029	Map Swtch 2 to Setpoint 2	no	yes	0
00030	Map Swtch 2 to Setpoint 3	no	yes	0
00031	Map Swtch 2 to Rotation Sensed	no	yes	0
00032 thru 00064	RESERVED			0

Location	Label
Read only bits	
10000's	Global Functions
10001	RESERVED
10002	RESERVED
10003	3.3V Power Supply Low
10004	3.3V Power Supply High
10005	5V Power Supply Low
10006	5V Power Supply High
10007	RESERVED
10008	RESERVED
10009	24V Power Supply Low
10010	24V Power Supply High
10011 thru 10016	RESERVED
10017	Hardware Reset Activated
10018	RESERVED
10019	Setpoint 1 Armed
10020	Setpoint 2 Armed
10021	Setpoint 3 Armed
10022	RESERVED
10023	Current Loop Open
10024	Current Loop Out of Range
10025	Digital Output #1 Activated
10026	Digital Output #2 Activated
10027	Setpoint 1 Tripped
10028	Setpoint 2 Tripped
10029	Setpoint 3 Tripped
10030	Rotation Sensed
10031 thru 10064	RESERVED

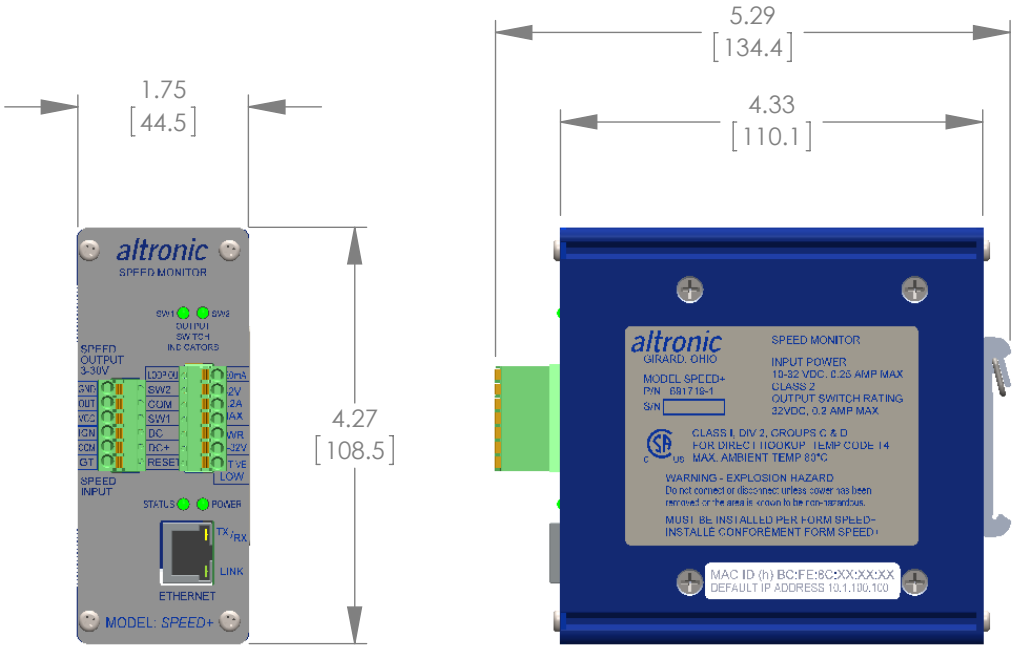
Location	Label
Read only bits	
30000's	Global Functions
30001	mirror of inputs 10016-10001
30002	mirror of inputs 10032-10017
30003	mirror of inputs 10048-10033
30004	mirror of inputs 10064-10049
30005	RESERVED
30006	Engine Acceleration RPM/sec
30007	Engine Speed RPM Filtered
30008	Engine Speed RPM*10 NOW
30009	RESERVED
30010	RESERVED
30011	Current Loop Output mA * 100
30012	RESERVED
30013	SUPPLY VOLTAGE 24V volts *10
30014 thru 30019	RESERVED
30020	Setpoint 1 State Time
30021	Setpoint 2 State Time
30022	Setpoint 3 State Time
30023 thru 30024	RESERVED

Location	Label	Min	Max	Default	Notes
Read/Write bytes					
40000's	Global Functions				
40001	mirror of coils 00016-00001	00000	65535	00000	
40002	mirror of coils 00032-00017	00000	65535	00000	
40003	mirror of coils 00048-00033	00000	65535	00000	
40004	mirror of coils 00064-00049	00000	65535	00000	
40005	RPM Filter	0	254	240	
40006	RESERVED				
40007	RESERVED				
40008	Maximum RPM	0	65000	1000	Cannot be changed while rotating
40009	Gearteeth / Pulses-per-Rev	1	1000	360	Cannot be changed while rotating
40010	KReloadDivider:KToothDly	257	65535	2815	Cannot be changed while rotating
40011	KTimeDly	1	255	3	Cannot be changed while rotating
40012	RPM_LB:ACC_LB	257	7681	6401	Cannot be changed while rotating
40013	Setpoint 1	0	65000	0	
40014	Setpoint 1 Trip Delay sec	0	999	0	
40015	Setpoint 1 Hysteresis sec	0	999	0	
40016	Setpoint 1 Hysteresis RPM	0	999	0	
40017	Setpoint 2	0	65000	0	
40018	Setpoint 2 Trip Delay sec	0	999	0	
40019	Setpoint 2 Hysteresis sec	0	999	0	
40020	Setpoint 2 Hysteresis RPM	0	999	0	
40021	Setpoint 3	0	65000	0	
40022	Setpoint 3 Trip Delay sec	0	999	0	
40023	Setpoint 3 Hysteresis sec	0	999	0	
40024	Setpoint 3 Hysteresis RPM	0	999	0	
40025	ACCEL Acc Err Limit RPM/sec	50	16383	2000	
40026 thru 40033	RESERVED				
40027	ACCEL Gain Accel 1-255	1	255	180	
40028	ACCEL Reset Rate 0.01-9.99s	1	999	40	
40029	ACCEL Brake Percent 1-100%	1	99	15	
40030	RESERVED				
40031	Current Loop Cal 20mA(AD cnts)	0	65535	54613	
40032	Current Loop Cal 4mA (AD cnts)	0	65535	10923	
40033	RESERVED				
40034	Current Loop RPM Value @4mA	0	65535	150	RPM @ 4mA
40035	Current Loop RPM Value @20mA	0	65535	800	RPM @ 20mA
40036 thru 40044	RESERVED				
40045	Gear Ratio - Numerator	1	1000	1	Cannot be changed while rotating
40046	Gear Ratio - Denominator	1	1000	1	Cannot be changed while rotating

Location	Label	Min	Max	Default	Notes
Read/Write bytes					
40000's	Global Functions				
40047 thru 40064	RESERVED				
40065	4-20mA Output Manual Control	4mA value as in reg 40032	20mA value as in reg 40031	0	Alternate 4-20ma Control Reg
40066	RESERVED				
40067	RESERVED				
40068	RESERVED				
40069	Key Command Argument	0	65535	0	
40070	Key Command	0	65535	0	

FIGURES SECTION:

FIGURE 1. MOUNTING DIMENSIONS AND SPECIFICATIONS



SPECIFICATIONS:

POWER REQUIRED: DC POWER 10-32 VDC, 0.25 AMP. MAX.

AMBIENT TEMPERATURE RANGE: -40°C TO 80°C (-40°F TO 176°F)

MOUNTING: MOUNTS TO 35MM DIN RAILS

ENCLOSURE: EXTRUDED ALUMINUM, NEMA TYPE 1

INTEGRAL ETHERNET PORT FOR COMMUNICATIONS TO A PLC/PC OR OTHER COMMUNICATION DEVICE

SPEED INPUT PULSES FROM MAGNETIC PICKUPS, HALL-EFFECT SENSORS, OR “SHUTDOWN LEADS” FROM CD IGNITION SYSTEMS

INPUT FREQUENCY RANGE: 1HZ TO 100KHZ

RANGE: 0 TO 65000

ACCURACY: ±.5%, ± 1 DIGIT

UPDATE RATE: 30 MILISECONDS

CONFIGURABLE INPUT TO OUTPUT RATIO 1-1000

I/O AND POWER CONNECTIONS PLUGGABLE, PUSH-IN, SPRING-CAGE

EXTERNAL RESET INPUT: ACTIVATED BY MOMENTARILY PULLING INPUT LOW.

LED INDICATORS: POWER, STATUS, LINK, RX/TX, SW1, SW2

ANALOG CURRENT LOOP OUTPUT: 4-20MA FORWARD OR REVERSE ACTING

SETPOINT: 3 FULLY CONFIGURABLE

OUTPUT SWITCH: TWO PROGRAMMABLE SOLID STATE SWITCHES, RATED 32 VDC, 0.2 AMP CONTINUOUS, OPTICALLY ISOLATED FROM POWER SUPPLY.

SWITCH CONFIGURATIONS: NC/NO, FAILSAFE/SHELF

CONNECTOR, ETHERNET PORT: SHIELDED RJ45 SOCKET

NETWORK WIRING INTERFACE: AUTO MDI/MDIX

COMMUNICATION PROTOCOLS: Modbus/TCP, ETHERNET/IP

CONNECTIONS: UP TO 5 CONNECTIONS

DATA RATE: AUTO SENSED 10/100 Mbps

ADDRESS: AUTO IP, BOOT P, STATIC

IP ADDRESS: DEFAULT STATIC IP ADDRESS IS 10.1.100.100

HAZARDOUS AREA CLASSIFICATION: CLASS I, DIV. 2, GROUPS C & D FOR DIRECT HOOKUP, TEMP CODE T4, MAX. AMBIENT TEMP. 80°C.

FIGURE 2. GENERAL ELECTRICAL CONNECTIONS

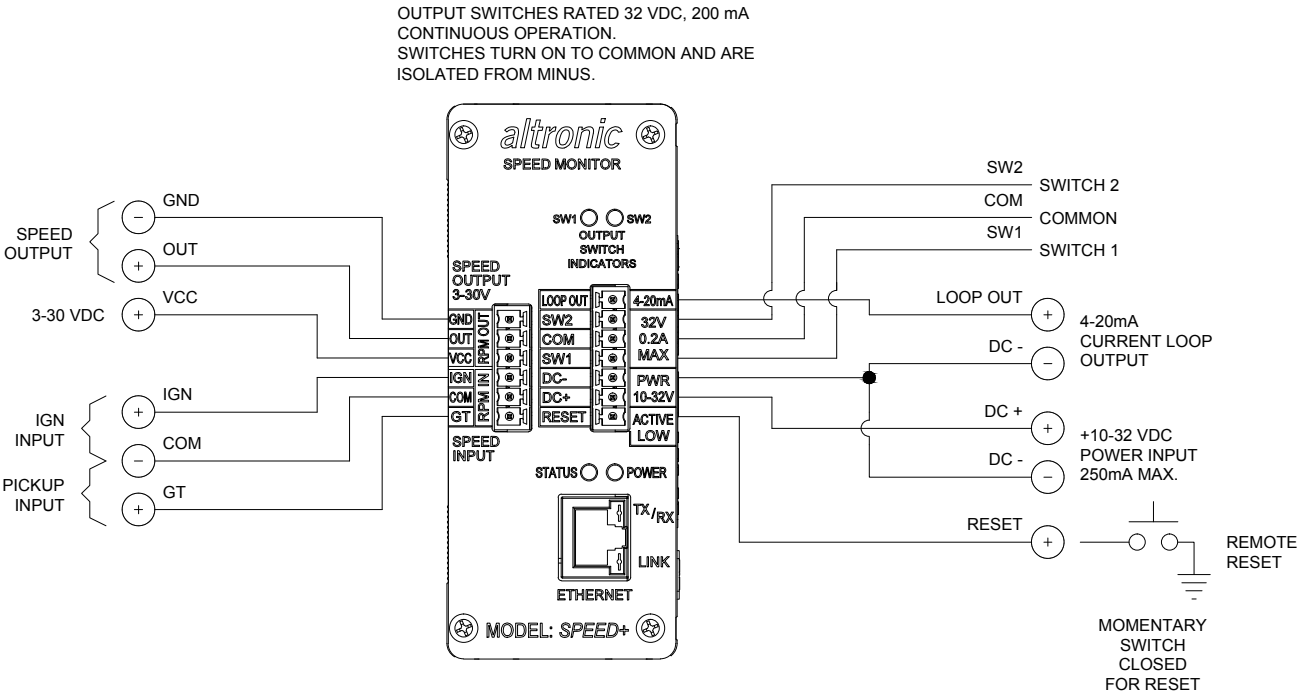


FIGURE 3A. WIRING DIAGRAM – MAGNETIC PICKUP INPUT

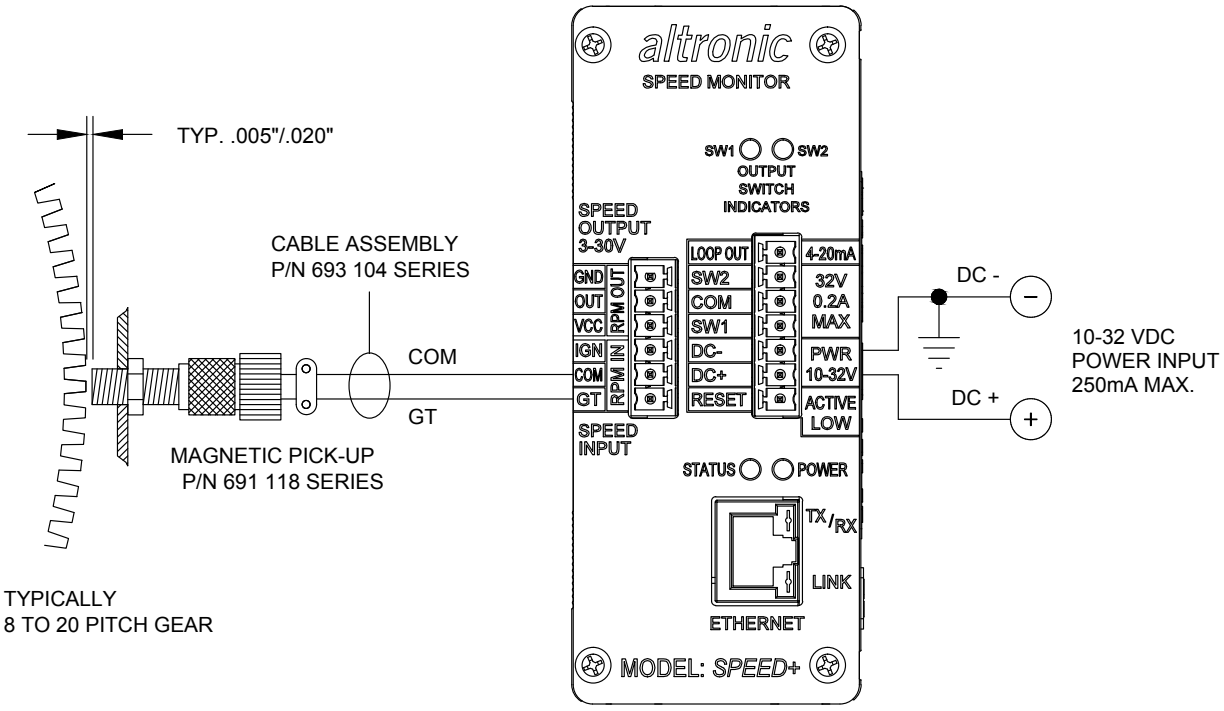


FIGURE 3B. WIRING DIAGRAM – HALL-EFFECT PICKUP INPUT

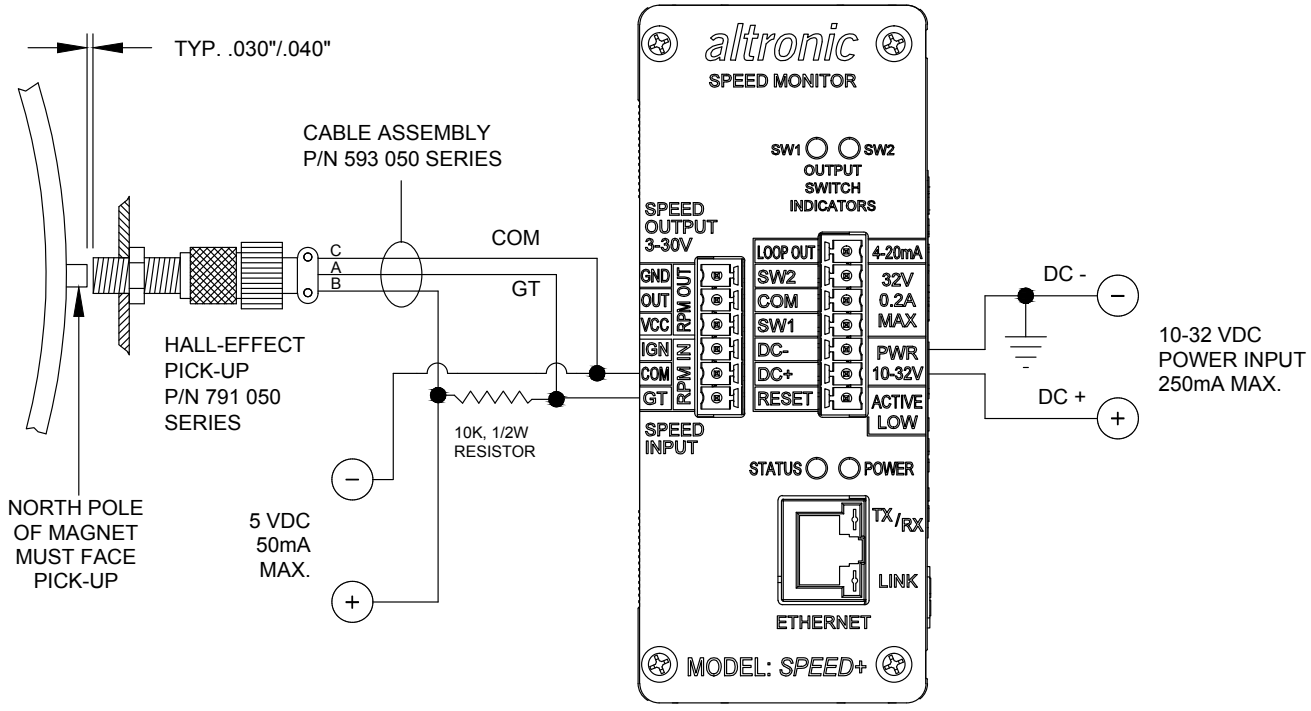
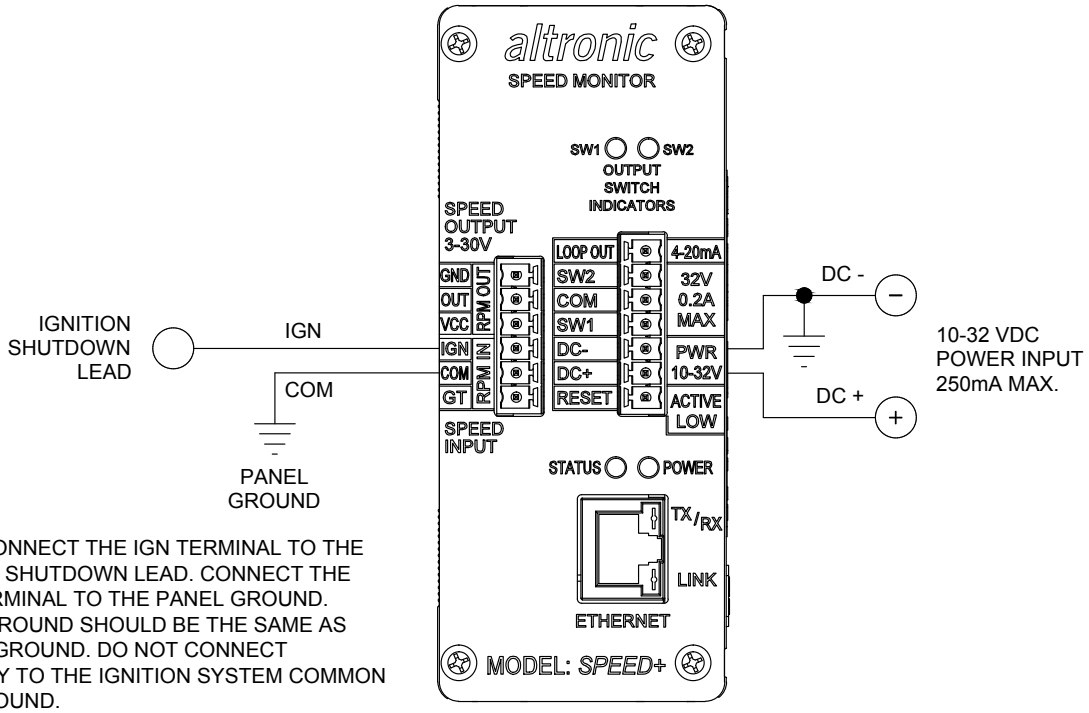
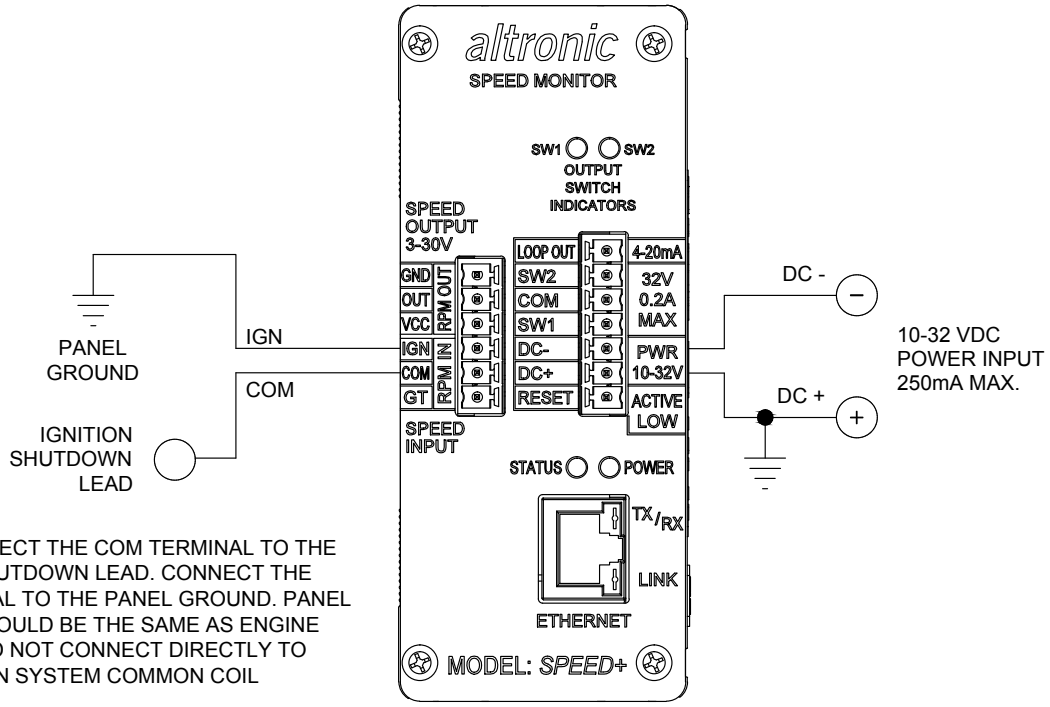


FIGURE 4A. WIRING DIAGRAM – NEGATIVE GROUND C.D. IGNITION SHUTDOWN LEAD INPUT



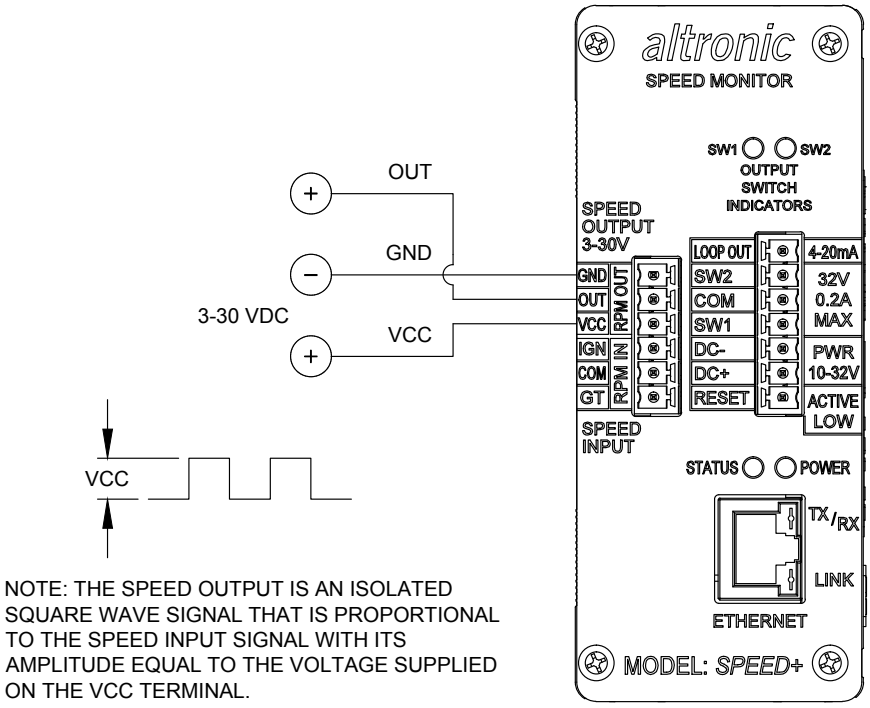
NOTE: CONNECT THE IGN TERMINAL TO THE IGNITION SHUTDOWN LEAD. CONNECT THE COM TERMINAL TO THE PANEL GROUND. PANEL GROUND SHOULD BE THE SAME AS ENGINE GROUND. DO NOT CONNECT DIRECTLY TO THE IGNITION SYSTEM COMMON COIL GROUND.

FIGURE 4B. WIRING DIAGRAM – POSITIVE GROUND C.D. IGNITION SHUTDOWN LEAD INPUT



NOTE: CONNECT THE COM TERMINAL TO THE IGNITION SHUTDOWN LEAD. CONNECT THE IGN TERMINAL TO THE PANEL GROUND. PANEL GROUND SHOULD BE THE SAME AS ENGINE GROUND. DO NOT CONNECT DIRECTLY TO THE IGNITION SYSTEM COMMON COIL GROUND.

FIGURE 5A. WIRING DIAGRAM – SPEED OUTPUT



NOTE: THE SPEED OUTPUT IS AN ISOLATED SQUARE WAVE SIGNAL THAT IS PROPORTIONAL TO THE SPEED INPUT SIGNAL WITH ITS AMPLITUDE EQUAL TO THE VOLTAGE SUPPLIED ON THE VCC TERMINAL.

FIGURE 5B. WIRING DIAGRAM – CURRENT LOOP OUTPUT

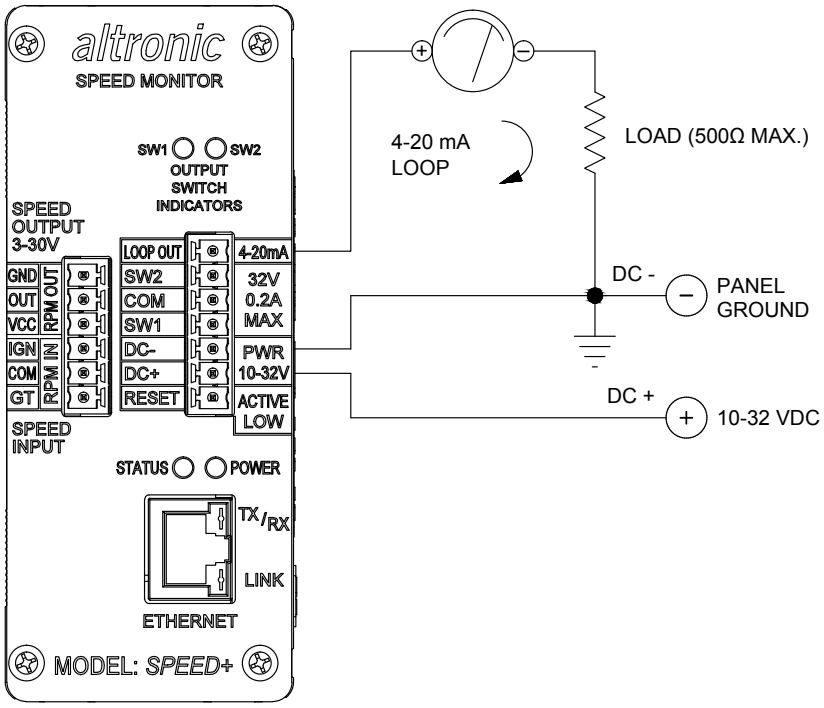
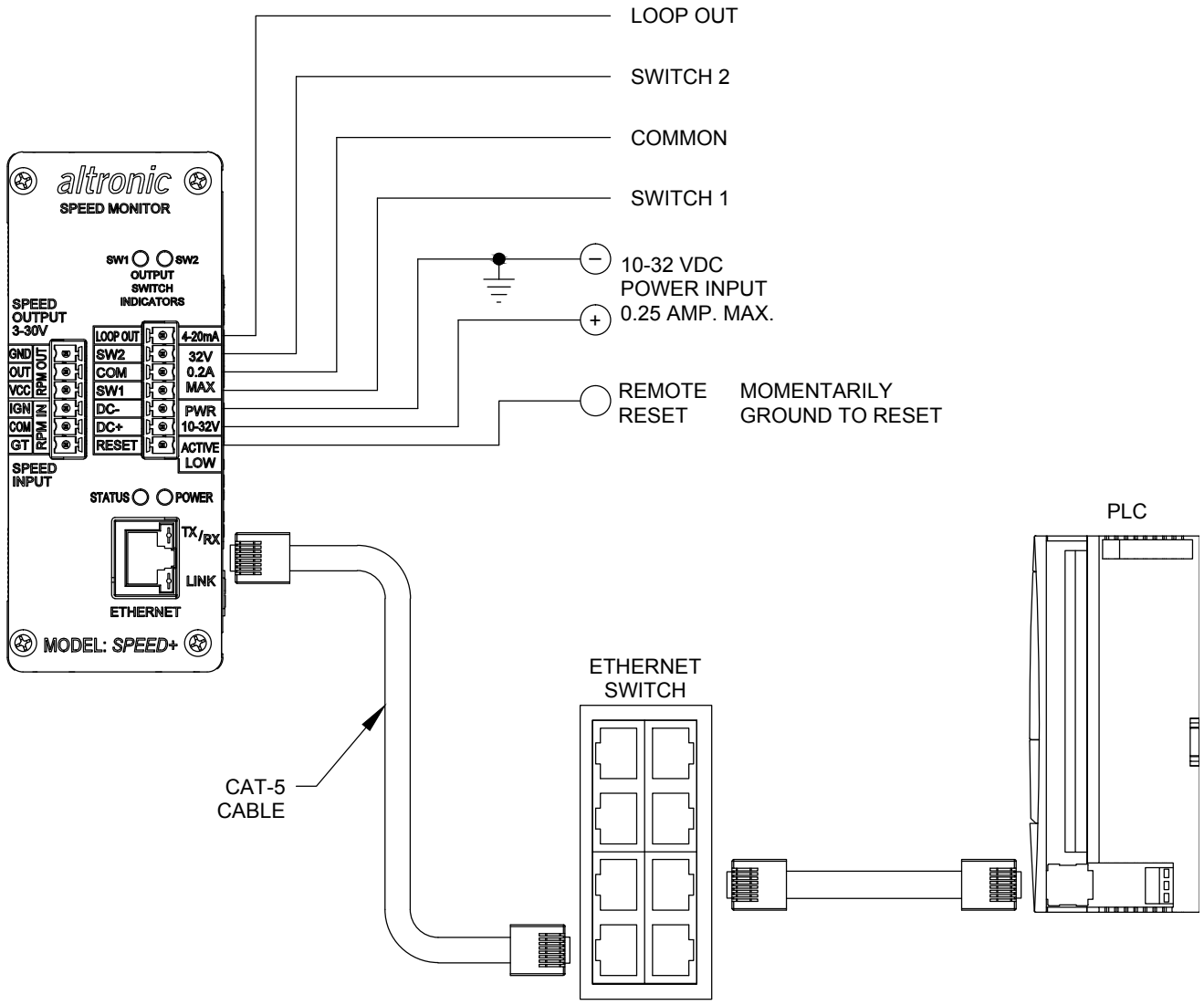


FIGURE 6. WIRING DIAGRAM – ETHERNET SWITCH



NOTES:

1. POWER WIRING,
   MUST BE POWERED FROM A CLASS 2 POWER SUPPLY. IT IS RECOMMENDED THAT THE CURRENT FROM THE POWER SUPPLY TO THE MODULE BE LIMITED THROUGH A PROPERLY SIZED SURGE TOLERANT FUSE OR ELECTRONIC BREAKER.

2. RJ45 ETHERNET COMMUNICATIONS WIRING,
   USE DATA GRADE CATEGORY 5E SHIELDED TWISTED-PAIR (STP) OR UNSHIELDED TWISTED-PAIR (UTP) CABLE THAT HAS A 100Ω CHARACTERISTIC IMPEDANCE THAT MEETS THE EIA/TIA CATEGORY FIVE (CAT-5) WIRE SPECIFICATIONS. MAX. WIRE LENGTH IS 100 METERS / 325 FEET.

3. OUTPUT SWITCHES ARE RATED 32 VDC, 200 mA MAX. EACH SWITCH TURNS ON TO COMMON WHICH IS ISOLATED FROM DC-.

4. SWITCH 1 IS CLOSED WITH THE ABSENCE OF POWER.

5. SWITCH 2 IS OPEN WITH ABSENCE OF POWER.