



Nidec-Avtron Makes the Most Reliable Encoders in the World

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Encoder Instructions

MODEL HS6M

HOLLOW SHAFT 6-15mm

DESCRIPTION

The Avtron Model HS6M is a light mill duty absolute encoder. It expresses the position of rotation as an output message or value. HS6M can measure a single turn of rotation or multiple rotations. The HS6M measures the shaft rotation and position without the need for external power or internal batteries or capacitors through its innovative Wiegand wire energy system. The HS6M operates down to zero speed and can be used for both control and instrumentation applications.

CAUTION

Do not utilize HS6M in hazardous locations which require ATEX, UL, CUL, CSA, or other explosion protection certification. AV6M is not certified for hazardous locations.

When mounted to a machine shaft, the HS6M design eliminates the need for shaft couplings, adapter flanges, or accessory mounting faces. The clamping collar holds the HS6M in place.

For larger bore/ larger frame size units, shaft inserts are available to resize from native bores to smaller sizes. An anti-rotation arm prevents housing rotation while allowing for shaft end float.

The HS6M utilizes magnetic sensors. This proven technology is ideal for rugged environments since it is immune to many contaminants that cause optical encoders to fail.

SAFETY

The HS6M is not considered as a safety device and is not suitable for connection into a safety system.

CAUTION

Be careful not to damage clamping fingers of hollow shaft during handling. Do not tighten clamping collar before installation onto motor shaft.

WARNING

Installation should be performed only by qualified personnel. Safety precautions must be taken to ensure machinery cannot rotate and all sources of power are removed during installation.

INSTALLATION

Refer to the back page of these instructions for outline and mounting dimensions.

HS6M PART NUMBERS AND AVAILABLE OPTIONS										
Model	Bus	Housing	Bore Size	Turns/ bits	PPR/bits per turn	Connector	Mounting Style	Output	IP Rating	Special Option
HS6M	A- Analog C- CANOpen D- DeviceNet J- J1939 S- SSI	1- 58mm 3- 36.5mm 7- 42mm	L- 6mm M- 8mm N- 10mm P- 12mm R- 15mm Z- All metric sizes	X- 0/0- single turn A- 16/4 (analog) 2- 4096/12 3- 8192/13 5- 32768/15	2- 4096/12* 3- 8192/13 *use "2" also for analog output	A- 1xM12/5 pin C- M12 x3 pin E- 1xM12/8 pin F- M23/12 pin K- 3x cable entry W- Cable, 1m	E- EOS only	Digital 1- Binary 2- Gray Analog 3- V output 0-5V 4- V output 0-10V 5- I Output 4-20mA 6- I Output 0-20mA	X- no shaft seal, IP54, aluminum + steel housing A- IP65 seals, aluminum + steel housing K- IP69K stainless housing	000- none 9xx- special cable length xx=length *0.3m 001- pushbutton setpoints

HOUSING COMPATIBILITY		
Housing	Bore Size	IP/Sealing
1	M, N, P, R, Z	A, K
3	L	X, A
7	M, N, P	A

STANDARD CONNECTORS & OUTPUT FORMATS			
Bus	Code	Connectors	Output
Analog	A	A, W	3, 4, 5, 6
CANOpen	C	A, W	1
DeviceNet	D	A, W	1
J1939	J	A, W	1
SSI	S	E, F, W	1, 2

Equipment needed for installation

Supplied:

HS6M Encoder
Anti-Rotation Tether

Optional:

Shaft Sizing Insert

Not Supplied:

Wrenches
Dial Indicator Gauge
Caliper Gauge

The hollow shaft HS6M design eliminates the potential for coupling failures from misalignment, however, excessive housing movement (wobble) may cause undesirable vibrations and bearing damage. The higher the RPM, the more severe the vibration will be from housing movement. In a typical installation a housing movement of 0.004" [0.1mm] TIR or less (as measured at the outside diameter of the main encoder body) will not have an adverse effect.

- 1) Disconnect power from equipment and encoder cable.
- 2) Use caliper gauge to verify motor shaft is proper diameter and within allowable tolerances: +0.000", -0.0005" [+0.00, -0.013mm].
- 3) Clean machine shaft of any dirt and remove any burrs.
- 4) Use dial indicator gauge to verify the motor shaft: Total Indicated Runout (TIR) <0.002" [0.05mm].
- 5) Install the anti-rotation bracket tether to the face of the encoder included with the tether.
- 6) Loosen clamping collar screws.
- 7) Test Fitting: carefully slide the encoder onto the shaft to verify fit. Ensure a minimum of 1/16" [1mm] between encoder and mounting surface. DO NOT FORCE. Encoder should slide on easily. If the encoder does not fit easily, remove it, verify shaft size, and check for burrs and shaft damage.
- 8) Slide the HS6M onto the shaft. Ensure minimum insertion requirements shown on drawing page are met.
- 9) Tighten screws on clamping collar evenly until snug, then tighten each screw as follows:
For bore sizes up to 1" [25mm] 38 in-lb [4.3 Nm]
For bore sizes >1" [25mm] 66 in-lb [7.5 Nm]
DO NOT USE A STANDARD RIGHT ANGLE WRENCH. Use only a T-handle hex wrench or torque wrench with hex bit.
- 10) Secure free end(s) of the anti-rotation bracket to frame using bolt or T-bolt provided. The bracket should be parallel to the encoder face, 90 degrees to the shaft to avoid encoder bearing damage. Use additional washers as needed to ensure the tether is parallel to the encoder face.
- 12) Turn shaft by hand and verify the shaft turns freely and does not produce excessive runout/wobble of the encoder (<0.005" TIR [0.13mm], Total Indicated Runout.) Ensure the tether arm is secure and the encoder body cannot rotate.
- 13) Connect cable as shown in wiring diagram.
- 14) Apply power to the encoder.
- 15) Rotate the shaft by hand, or using jog mode of the speed controller and verify proper direction and position output.

ENVIRONMENTAL CONSIDERATIONS

Follow these steps to reduce potential problems:

- 1) Always mount connection points, conduit couplings, junction boxes, etc., lower than actual encoder.
- 2) For washdown areas, shroud or otherwise cover the encoder to prevent direct water spray. Do not attach the shroud directly to the encoder.

REPAIRS

REMOVAL INSTRUCTIONS:

1. Unbolt tether arm from mounting point(s) on motor.
2. Loosen clamping collar screw(s).
3. Slide the encoder off the motor.

REPLACING PARTS

The HS6M has two items that are user-replacable in the field in case of damage, or to change the encoder electrical or mechanical interface:

1. Shaft sizing insert: Simply slide the insert out of the HS6M and replace it with the new bore size insert. Insert should remove and install with modest force-do not pound the insert into the HS6M.
2. Tether system: To replace the tether system, remove the retaining screw(s), then replace with the new tether.

CAUTION

Do not attempt to remove, service, or adjust any of the internal components of the HS6M.

INSTALLATION

Refer to the back page of these instructions for outline and mounting dimensions.

Equipment needed for installation

Supplied:

Encoder

Optional:

(none)

Not Supplied:

Open Wrenches, Hex Wrenches, Dial Indicator Gauge
Caliper Gauge, Mounting Screws

WIRING INSTRUCTIONS

CAUTION

Remove power before wiring.

Interconnecting cables specified in the wire selection chart are based on typical applications. Refer to the system drawing for specific cable requirements where applicable.

Physical properties of cable such as abrasion, temperature, tensile strength, solvents, etc., are dictated by the specific application and communications bus. Do not use unshielded cable. Ground one end (only) of the shield to earth ground.

Do not run encoder wiring parallel to power cable wiring for extended distances, and do not wrap encoder cable around power cables.

TROUBLESHOOTING:

If the controller indicates a loss of encoder fault, check the encoder power supply at the encoder. If power is present at the encoder, check polarity. If the wiring appears correct and in good shape, test the wiring by replacing the HS6M. If the controller still shows encoder loss/fault, then the wiring is faulty and should be repaired or replaced.

An oscilloscope can also be used to verify output of the HS6M encoder at the encoder connector itself and at the drive/ controller cabinet. Depending on the communication method, signals will vary but the oscilloscope should show the output signals varying. Keep in mind that SSI and Profibus DP are master-slave systems and require the controller to signal the encoder to transmit position.

SSI TROUBLESHOOTING

For SSI, monitor the clock input line to ensure the controller is triggering the encoder to send position. The clock should obey the signal requirements shown in the SSI signal section, and should appear as a rapid set of transitions on the clock line. The encoder data transmit lines should change state as data is clocked out. Note that the varying binary patterns representing position can produce pulses of varying width--this is normal.

PROFIBUS-DP TROUBLESHOOTING

Viewing on oscilloscope: for Profibus DP, the transmit and receive signal pairs should change state rapidly as the controller transmits messages to the encoder and the encoder replies. Transmission rates vary, but these messages can be extremely short and typically require scope triggering to spot them.

For Profibus DP, ensure termination resistors are in place (or switched on) at each end of the cabling system, and that no termination resistors are in place or activated in the middle of the system. Remove the connections to the master controller and all devices, or power down all devices. Measure the resistance between the communication wires. The value should be $\sim 1/2$ of the termination resistor value on the network. If the resistance is greater than the limit, a termination resistor is missing from the network. If the resistance is less than the limit, there are incorrect termination resistors switched on or connected to the system.

CANOPEN TROUBLESHOOTING

For CANOpen: disconnect the power connection, then ensure there are no short circuits between any of the signal or power wires or shield.

Viewing on oscilloscope: for CANOpen the transmit and receive signal pairs should change state rapidly as the controller transmits messages to the encoder and the encoder replies. Transmission rates vary, but these messages can be extremely short and typically require scope triggering to spot them.

For CANOpen, ensure termination resistors are in place (or switched on) at each end of the cabling system, and that no termination resistors are in place or activated in the middle of the system. Remove the connections to the master controller and all devices, or power down all devices. Measure the resistance between the communication wires [Example CANOpen-measure between CAN_L and CAN_H]. The value should be $\sim 1/2$ of the termination resistor value on the network. For CANOpen, this value should be >50 ohms, <65 ohms. If the resistance is greater than the limit, a termination resistor is missing from the network. If the resistance is less than the limit, there are incorrect termination resistors switched on or connected to the system.

Some housing styles include a two-color diagnostic LED. Red indicates an error, Green indicates run status. During normal operation, the encoder LED should be continuously green. Flash patterns indicate activity as follows:

RED - Error

Flickering - (Autobitrate/LSS services are in process)

Blinking - Configuration error

- 1) Flash - CAN bus frame error
- 2) Flashes - CAN guard timing or heartbeat error
- 3) Flashes - Sync message timeout
- 4) Flashes - PDO message timeout

ON - CAN Controller is in bus off state

GREEN - Run

Flickering - (Autobitrate/LSS services are in process)

Blinking - Encoder is in preoperational mode

- 1) Flash - Encoder is in stopped mode
- 3) Flashes - Software download in progress

ON - Encoder is operating normally with no errors

Nidec-Avtron recommends the use of a simple no-cost debugging tool such as PCAN View.

Ensure the device is set to the proper baud rate (connection cap, or for units with no connection cap, via software)

Ensure the device is set to the proper node address (connection cap or for units with no connection cap, via software)

The encoder will power-up in the pre-operational mode. The message it will issue is:

ID: 0x07nn 0x00

If you cannot see this message, try power cycling the device.

Note that CANOpen units with a hardware connection cap are typically set to 20K default baud rate. Not all master devices support 20K, so the power-up message may not be displayed. Check the baud rate and node address on the connection cap.

ANALOG TROUBLESHOOTING

For analog output, a multimeter can be used to measure the output signal. Disconnect the encoder outputs (but maintain the power connection) to ensure no interference from field wiring and measure the output voltage or current directly at the encoder depending on the output style selected. Rotating the shaft should produce a change in output value.

For analog output: If the output is within the expected range but does not seem to change, the analog value may have been accidentally scaled to a tiny fraction of a revolution or such a huge number of turns that the output change cannot be detected.

Connect both Set End Point 1 and Set End Point 2 to +Vs for 1 second or more, then connect them to ground or no connection. The encoder will be reset to use the full scale factory default with the output and position set to the mid-point of the full scale. Now monitor output voltage or current while rotating. You should observe a voltage or current change. Now follow the instructions in the analog section to properly reset the analog minimum and maximum values.

ELECTRICAL SPECIFICATIONS

A. Operating Power (Vin = +Vs)

1. Voltage & Current

Analog V Out.....	12-30VDC; 15mA @ 24V
Analog I Out.....	15-30VDC; 40mA @ 24V
CANOpen.....	10-30VDC; 230mA @ 10V, 100mA @24V
DeviceNet.....	10-30VDC; 230mA @ 10V, 100mA @24V
J1939.....	10-30VDC; 230mA @ 10V, 100mA @24V
Profibus DP.....	10-30VDC; 230mA @ 10V, 100mA @24V
SSI.....	5-30VDC; 125mA @ 5VDC, 30mA @ 24V

2. Total Current..... as above plus cable load

B. Output Format

1. Analog Voltage..... 0.5-4.5V; 0-5V; 0.5-9.5V; 0-10V

Current..... 0-20mA or 4-20mA

2. SSI..... 100kHz-2mHz, set by master clock speed

3. CANOpen..... 20kbaud to 1Mbaud, node 0-127

Default 125k, node 32 (0x20) -w/o connection cap

Default 20k, node 01 (0x01) -w/connection cap

4. DeviceNet..... 125kHz-500kHz, MAC-ID 0-63

Default 125k, node 63 (3FH) -w/o connection cap

5. Profibus DP..... 9.6Kbaud to 12Mbaud, node 0-99

Default Auto-Baud, node 00 (00H)

DPV1 (master/slave standard)

DPV2 (isochronous, optional)

C. Direction Counting..... Default up for CCW rotation as viewed from the back of the encoder

D. Counts Per Turn..... 4096 - 8192 (12 - 13 bits)

E. Maximum Turns..... 4096 - 32768 (12 - 15 bits)

F. Line Driver Specs..... See table

G. Connectors..... See connector options on page 1

H. Accuracy..... +/-0.35 deg (+/-21 arc-min) Analog Linearity: 0.15%

Housing Size	Bore Range	Min Insertion	Max Insertion
36mm	6mm	16mm	18mm
42mm	8-12mm	16mm	18mm
58mm	8-15mm	25mm	30mm

MECHANICAL

A. Shaft Inertia..... 0.18lb-in-sec² [315 g-cm² (dyn)]

B. Acceleration..... 6000 RPM/Sec. Max.

C. Speed..... 6000 RPM Max 12000 RPM Max. w/o seals, not recommended

D. Weight..... 0.33-0.4 lbs [150-180g]

E. Vibration any orientation 10 Gs, 5-2000 Hz

30 Gs, 5-2000 Hz

F. Shock any orientation 200 Gs 3mSec

300 Gs 6mSec, flanges "6", "7"

G. Shaft Load..... 25lbs Radial (110N) Max.

9lbs Axial (40N) Max.

40lbs Radial (180N) Max., flanges "6", "7"

40lbs Axial (180N) Max., flange "6", "7"

ENVIRONMENTAL

Solid cast aluminum housing

Solid stainless steel housing optional

Operating Temperature..... -30°C to +85°C.

Finish..... Powder Coat. Resists mild acids, bases, salt water & hydrocarbons

		BUS OPTIONS						
Electrical Specifications		Analog	CANOpen	DeviceNet	J1939	Profibus	SSI	Units
Input Voltage		12-30V	10-30V	TBD	10-30V	10-30V	10-30V	VDC
Cable Drive Capacity		NA	8200' [2500m]	1650' [500m]**	TBD	4000' [1200m]	4000' [1200m]	feet
Protection	Reverse Voltage	yes	yes	yes	yes	yes	yes	
	Short Circuit	yes	yes	yes	yes	yes	yes	
	Transient	yes	yes	yes	yes	yes	yes	

All cable lengths shown with optimal cable and minimum supported baud rate:

SSI: @100kbaud w/24 AWG, 52.5 pF/meter (16 pF/foot)

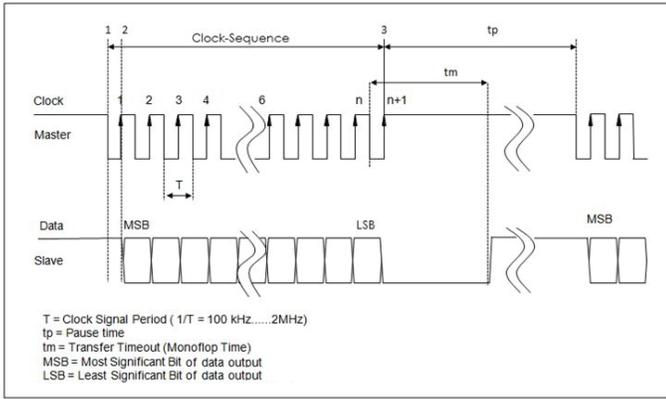
DeviceNet: Using main cable (round, large diameter)

CANOpen: @20kbaud

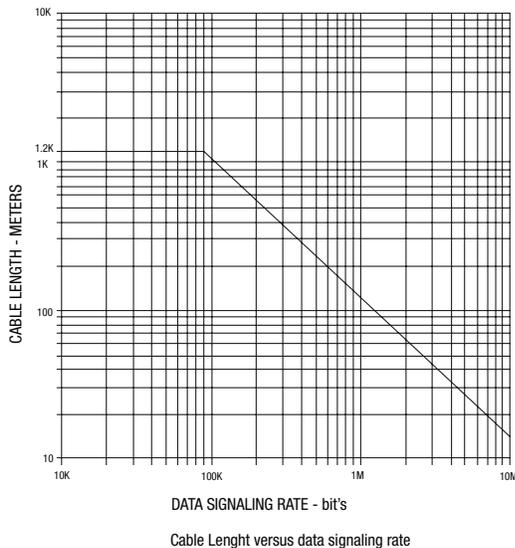
Profibus DP: 9.6Kbaud, 150ohm cable, <10pf/ft

SSI Protocol "S"

The SSI Protocol "S" provides a clocked set of data bits that represent the encoder position (in turns and within 1 turn). Each bit is output by the encoder as the clock input transitions.



Preferred cable: Twisted pair with individual and overall shield grounded at one end only. 24 AWG, copper conductor, capacitance of 52.5 pF/meter (16 pF/foot) terminated in a 100 Ohm resistive load. Note that resistive losses in long cables may decrease actual voltage (+Vs) available at the encoder; larger conductors can be used or the encoder can be powered locally and signal GND brought through the cable. Maximum transmission speed is limited by cable length as shown in the figure below.



For more details on SSI, consult Wikipedia:
http://en.wikipedia.org/wiki/Synchronous_Serial_Interface

Set Zero (input, ACTIVE HIGH, Falling Edge, 10K resistance)

To set the encoder count value to zero, raise Set Zero > 10V, < Vs for more than 1 second. Upon the Set Zero signal returning to logic zero (falling edge), the encoder count value will be set to zero.

Set Direction (input, 10K resistance)

For input logic zero or no connection, the encoder will count UP for CCW rotation as viewed from the rear end of the encoder.

For input logic 1 (>10V, <Vs), the encoder will count DOWN for CCW rotation as viewed from the rear of the encoder.

Analog Protocol "A"

The analog protocol provides a steady-state analog output which represents the encoder position over a portion of a turn or any portion of a turn plus a number of turns. The factory default is 0-16 turns = min/max output. This can be modified by using the Set Lower and Set Upper End Point inputs similar to most electronic cam-setting systems (described below.)

Preferred cable: Overall shield grounded at one end only. Twisted pair cable acceptable but not required. Note that resistive losses in long cables may decrease actual voltage (+Vs) available at the encoder; larger conductors can be used or the encoder can be powered locally and signal GND brought through the cable.

Output	0-5V	0-10V	0.5-4.5V	0.5-9.5V	4-20mA	0-20mA	Units
Signal Code	"3"	"4"	"7"	"8"	"5"	"6"	
Min. Supply Voltage	12V	12V	12V	12V	15V	15V	Vdc
Min. Load	10k	10k	10k	10k	0	0	ohms
Max. Load	Any	Any	Any	Any	500	500	ohms
Settle Time	80mS						mS
Min. Travel Turns	0.06 turns /22.5 deg.						Turns/Deg.
Max. Travel Turns	65536 turns						Turns

Set Lower End Point 1 (input, ACTIVE HIGH, Falling Edge, 10K resistance)

To set the encoder output to the minimum value at the present position of rotation, raise Set Lower End Point 1 > 10V, < Vs for more than 1 second. Upon the Set Lower End Point 1 signal returning to logic zero (falling edge), the encoder output will be set to the minimum output shown in the output table.

Set Upper End Point 2 (input, ACTIVE HIGH, Falling Edge, 10K resistance)

To set the encoder output to the maximum value at the present position of rotation, raise Set Upper End Point 2 > 10V, < Vs for more than 1 second. Upon the Set Upper End Point 2 signal returning to logic zero (falling edge), the encoder output will be set to the maximum output shown in the output table.

Reset Upper and Lower End Points to Factory Default (16 turn scaling)

Restore Factory Endpoint Settings (End Point 1, 2) (input, ACTIVE HIGH, Falling Edge, 10K resistance)

Raise both Set Lower End Point 1 and Set Upper End Point 2 > 10V, < Vs for more than 1 second. Upon both signals returning to logic zero, the encoder output will be reset to the factory default scaling of maximum output over 16 turns (only applies to the MT option, and the present position and the encoder will be set to the mid-point (8 turns) = 1/2 of the maximum output.

CANOpen Protocol “C”

The CANOpen protocol provides a set of data bits inside a CANOpen message that represent the encoder position (in turns and within 1 turn).

CANOpen may be wired in several different configurations, but the most common is a “Trunk and Drop Line” configuration. The trunk message cable must be terminated at each end with 120 ohm resistors. Note that CANOpen also offers the option to carry device power to each encoder through an additional cable pair of wires.

Preferred cable: Twisted pair with individual pair and overall shields. Communication pair: 24 AWG, copper conductor, capacitance of 50 pF/meter (15 pF/foot) terminated in a 120 Ohm resistive load. Power pair: 22AWG copper conductor, 17ohms/1000 ft [55 ohms/km]. Note that resistive losses in long cables may decrease actual voltage (+Vs) available at the encoder; larger conductors can be used or the encoder can be powered locally and signal GND brought through the cable. Maximum transmission speed is limited by cable length and number of devices as shown in the figures below.

Nidec-Avtron recommends the use of a simple no-cost debugging tool such as PCAN View.

For more details on CANOpen, consult the CiA, CANOpen in Automation:
www.can-cia.org

Network Baud Rate	1M	500K	250K	125K	50K	20K	Units
Max. Length	65 [20]	325 [100]	800 [250]	1600 [500]	3250 [1000]	8200 [2500]	ft [m]
Max. Single Tap Length	1 [0.3]	15 [5]	15 [5]	15 [5]	200 [60]	500 [150]	ft [m]
Max. Total Tap Length	5 [1.5]	100 [30]	200 [60]	400 [120]	1000 [300]	2500 [750]	ft [m]
Min. Tap to Tap Length	- [-]	20 [6]	20 [6]	20 [6]	240 [72]	600 [180]	ft [m]

Setting Node Number, Baud Rate & Termination Resistor

NOTE: Units with hardware connection caps cannot accept software-commanded address, baud rate or termination resistor changes. These must be made using the switches in the connection cap. Before commencing any changes, check for a connection cap. It is secured to the rear of the encoder with 2 or 3 screws and due to snug fit will require a strong pull to remove it after removing the screws.

NOTE: Any changes to baud rate, node number, or resistor will not take effect until the encoder is reset (typically power cycled).

Power-Up Sequence

The encoder will power-up in the pre-operational mode. The message it will issue is:

ID: 0x07nn 0x00
nn=node number, typically:
0x01 for units with connection cap including hardware node and baud rate selection. (software commands will not change node)
0x20 is the factory default for units with software-selectable addressing. (software commands can change node number)

Setting Node Number:

To set the node number: write SDO object 0x3000 using command 0x22. The encoder internally adds 1 to the written value.

Example, encoder at node 20, change node address to 02:

ID: 0x620 0x22 0x00 0x30 0x00 0x01 0x00 0x00 0x00

Setting Baud Rate:

To set the baud rate: write the baud code to SDO object 0x3001. Example, encoder at node 20, change baud rate to 125K = 0x03
ID: 0x620 0x22 0x01 0x30 0x00 0x03 0x00 0x00

Network Baud Rate	1M	500K	250K	125K	50K	20K
Baud Code	07h	05h	04h	03h	01h	00h

To enable the termination resistor: write 01 to SDO object 3002h. Ensure any devices on the bus power up at least 700mS after the encoder with the termination resistor activated.

Saving Changes (Required):

To save baud rate/node/resistor changes, write 0x55 0xAA 0xAA 0x55 to SDO object 0x2300
Example, encoder at node 20, store changes
ID: 0x620 0x22 0x00 0x23 0x00 0x55 0xAA 0xAA 0x55

Cycle power after saving changes.

Measuring Position, Speed, and Acceleration

To read position and speed feedback into your device (Acceleration measurement is not supported.): Following the instructions for your master/scanner module for the CANOpen network, load the encoder EDS file into your configuration. Assign it to the correct node number. Store the configuration to the scanner module. All of the position data and other parameters will be read by the scanner module and placed in registers identified in the configuration package.

Reading data without using the EDS file:

To read position: read SDO object 0x2000 (32 bit unsigned) or SDO object 0x6004.

Speed measurement is deactivated by default.

To enable speed measurement: write 0x01 to SDO object 0x3010, subindex 1, and write the speed modulus to subindex 2.

To read the speed after activation: read SDO object 0x3011 (8 bit unsigned) or SDO object 0x6030.

Acceleration measurement is not supported. SDO object 0x3021 and 0x6040h are reserved for future use but do not indicate acceleration at this time.

Setting Polling, Cyclic and Sync Mode

Polling, cycling and sync mode are supported by the encoder; use the parameters supplied in the EDS file to set the appropriate mode. Store the resulting configuration into the scanner module.

Storing/Saving Encoder Parameters

To store the current encoder operating parameters into non-volatile memory:

Write 0x55 0xAA 0xAA 0x55 to SDO object 0x2300

Example, encoder at node 20, store changes
ID: 0x620 0x22 0x00 0x23 0x00 0x55 0xAA 0xAA 0x55
No reset is triggered.

Cycle power after saving changes to parameters.

Other Parameters

Contact Nidec Avtron for additional parameters, diagnostic registers, cam and programmable limit switch functionality and other advanced features.

DeviceNet Protocol “D”

The DeviceNet protocol provides a set of data bits inside a DeviceNet message that represent the encoder position (in turns and within 1 turn).

DeviceNet may be wired in several different configurations, but the most common is a “Trunk and Drop Line” configuration. The trunk message cable must be terminated at each end with 120 ohm resistors. Note that DeviceNet also offers the option to carry device power to each encoder through an additional cable pair of wires.

Preferred cable: Nidec Avtron recommends structured DeviceNet wiring systems, available from a broad range of vendors. Large diameter main, small diameter round cable, as well as flat cabling systems are all acceptable.

For more details on DeviceNet, consult the Open DeviceNet Vendor’s Association (ODVA):

www.odva.org

Network Baud Rate	500K	250K	125K	Units
Max. Length*	325 [100]	800 [250]	1600 [500]	ft [m]
Max. Single Tap Length	15 [5]	15 [5]	15 [5]	ft [m]
Max. Total Tap Length	100 [30]	200 [60]	400 [120]	ft [m]
Min. Tap to Tap Length	20 [6]	20 [6]	20 [6]	ft [m]

Setting Node (MAC-ID), Baud Rate & Termination Resistor

To set the node MAC-ID number: write attribute 6Fh (byte).

To set the baud rate: write the baud code to attribute 6Eh (byte).

Network Baud Rate	500K	250K	125K	Units
Baud Code	02h	01h	00h	

Remember, these values are not stored permanently and do not take effect until they are written to EEPROM. If power is cycled before the values are stored, the encoder will default to the values previously stored in EEPROM.

To enable the termination resistor: write 01 to attribute 67h. Ensure any devices on the bus power up at least 700mS after the encoder with the termination resistor activated.

Measuring Position, Speed, and Acceleration

Only position feedback is supported in DeviceNet; acceleration and speed are not available at this time.

To read position feedback into your device: Following the instructions for your master/scanner module for the DeviceNet network, load the encoder EDS file into your configuration. Assign it to the correct MAC-ID node number. Store the configuration to the scanner module.

All of the position data and other parameters will be read by the scanner module and placed in registers identified in the

configuration package.

Setting Polling, Cyclic and Sync Mode

Polling, cycling and sync mode are supported by the encoder; use the parameters supplied in the EDS file to set the appropriate mode. Store the resulting configuration into the scanner module.

Storing/Saving Encoder Parameters to EEPROM

To store the current encoder operating parameters into non-volatile memory:

Send message [(master MAC-ID) 32h 23h 01h]. A new allocation is then required to resume receiving position values from the encoder.

Other Parameters

Contact Nidec-Avtron or review the EDS file for additional parameters, diagnostic registers, cam and programmable limit switch functionality and other advanced features.

Profibus DP Protocol “P”

Profibus DP is typically a master-slave network-the master/scanner device gathers data from each (slave) device on the bus. Avtron encoders are Profibus DP slave devices.

Profibus may be wired in several different configurations, but the most common is a “Daisy-Chain” configuration. The master/scanner device may be located at any point along the bus. The cable must be terminated at each end with 150 ohm resistors. Note that Profibus DP also offers the option to carry device power to each encoder through an additional cable pair of wires.

Preferred cable: Nidec Avtron recommends structured Profibus DP wiring systems, available from a broad range of vendors.

For more details on Profibus, consult the Profibus Users Association (PI):

<http://www.profibus.com/>

Number of Nodes	2	16	32	64	Units
Max. Overall Cable Length*	750 [229]	690 [210]	640 [190]	560 [170]	ft [m]

Network Baud Rate	12M 6M 3M	1.5M	500K	187.5K	93.75K 45.45K 19.2K 9.6K	Units
Max. Length*	325 [100]	650 [200]	1300 [400]	3250 [1000]	4000 [1200]	ft [m]

*Using Profibus standard cable, 150 ohm impedance 3-20mHz, <30pf/m, <110 ohms/km loop resistance

Setting Station/Node, Baud Rate & Termination Resistor

To set the node number: use the rotating switches in the connection cap. The format is decimal, from 0-99 (ten’s switch and one’s switch). Software/master address changes are not supported. NOTE: Each device must have a unique node address, and this address must be different than the master/scanner module.

Profibus DP baud rate is auto-detected by the encoder, no settings are required. 12 MBaud, 6 MBaud, 3 MBaud, 1.5 MBaud, 500 kBaud, 187.5 kBaud, 93.75 kBaud, 45.45 kBaud, 19.2 kBaud, 9.6 kBaud are all supported.

To enable the termination resistor: Move the switch “R” to the “On” Position on the connection board. The termination resistor should be turned on/enabled when the encoder is the last/only device on the bus. Note that standard 9 pin DIN connectors used for Profibus DP also offer a termination resistor. Be sure NOT to enable both the encoder termination resistor and the 9-pin connector resistor, use one or the other for an encoder at the end of a bus.

Measuring Position, Speed, and Acceleration

To read position and speed feedback into your device (Acceleration measurement is not supported.): Following the instructions for your master/scanner module for the Profibus DP network, load the encoder GSD file into your configuration. Assign it to the correct node number. Store the configuration to the scanner module. All of the position data and other parameters will be read by the scanner module and placed in registers identified in the configuration package.

For multiturn & single turn encoders: position data provided as 4 bytes, 32 bits: Format is little-endian (lowest bit = right-most bit). Single-turn data/data within 1 turn is provided in the least-

significant bits. Multiturn data is provided directly “above” the single turn data, bitwise. Example: 12 turns x 13 bits/turn encoder, lowest 13 bits = position within one turn, next 12 bits (up to bit 25) represent turns position data.

Setting Zero Position for Multiturn Encoders and Single turn Encoders Using 32 Bit Feedback:

Write 1 to the highest bit (31)-write 128 (80H) to top-most-byte of the position register.

For single turn encoders: position data can instead be provided as 2 bytes, 16 bits: Format is little-endian (lowest bit = right-most bit).

Setting Zero Position for Single turn Encoders Using 16 Bit Feedback :

Write 1 to the highest bit (15)-write 128 (80H) to top-most-byte of the position register.

Isochronous (Auto-Transmit) Mode

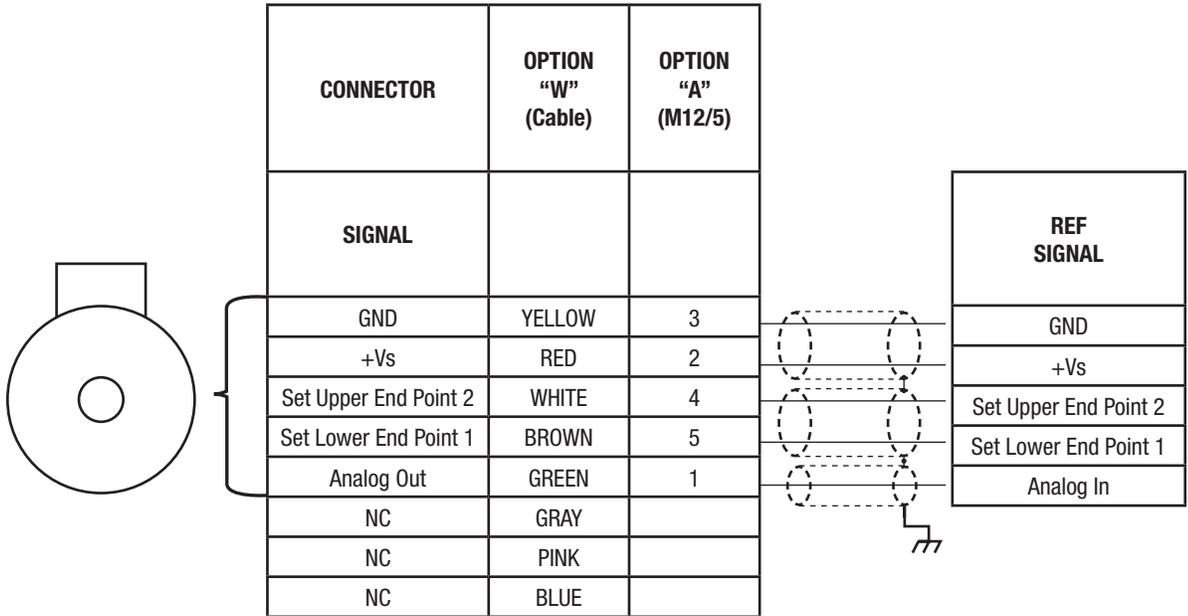
DPV2 Isochronous communication can be configured using the optional DPV2 GSD file. Load the encoder GSD file into your master/scanner software. Assign it to the correct node number. Store the resulting configuration into the scanner module. Note many Profibus master devices do not support isochronous mode-check the master device manual before utilizing this encoder mode.

Other Parameters

Contact Nidec Avtron for additional parameters, diagnostic registers, cam and programmable limit switch functionality and other advanced features.

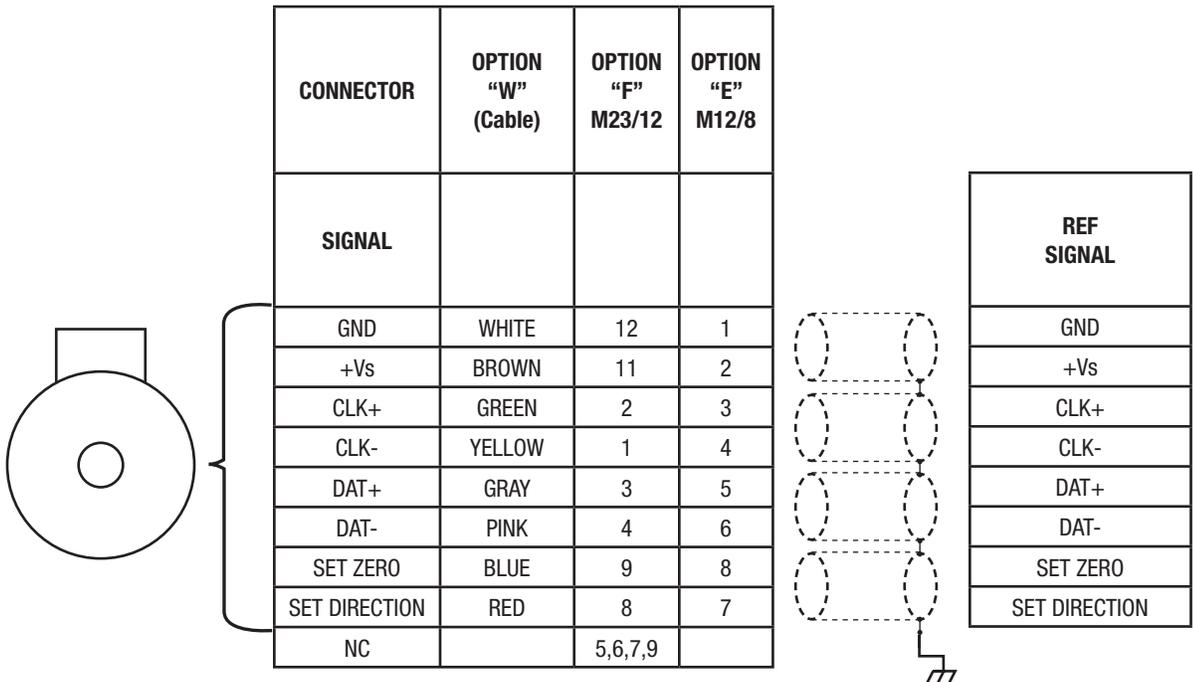
HS6M WIRING DIAGRAMS

Communication Bus "A": Analog Pinout



* Note: Overall shield required; twisted pair cable not required, pairs shown only for convenience

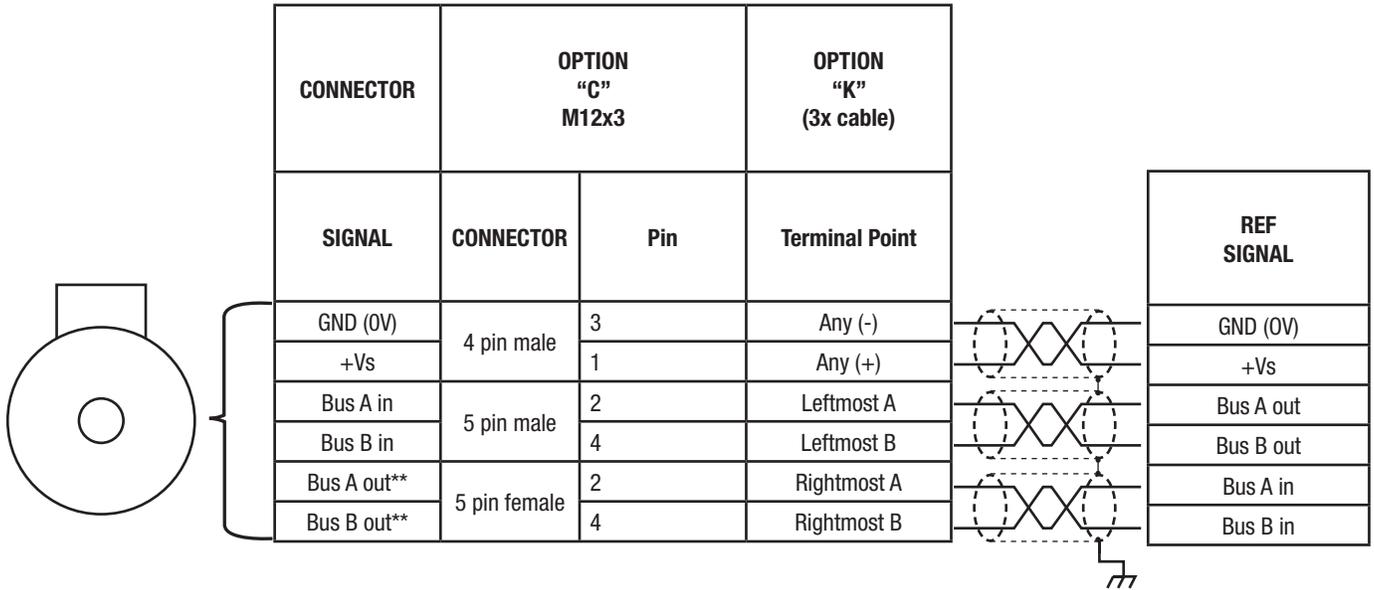
Communication Bus "S": SSI Pinout



* NOTE: Twisted pair cable required with overall shield; individual pair shielding recommended. Obey pairing as shown

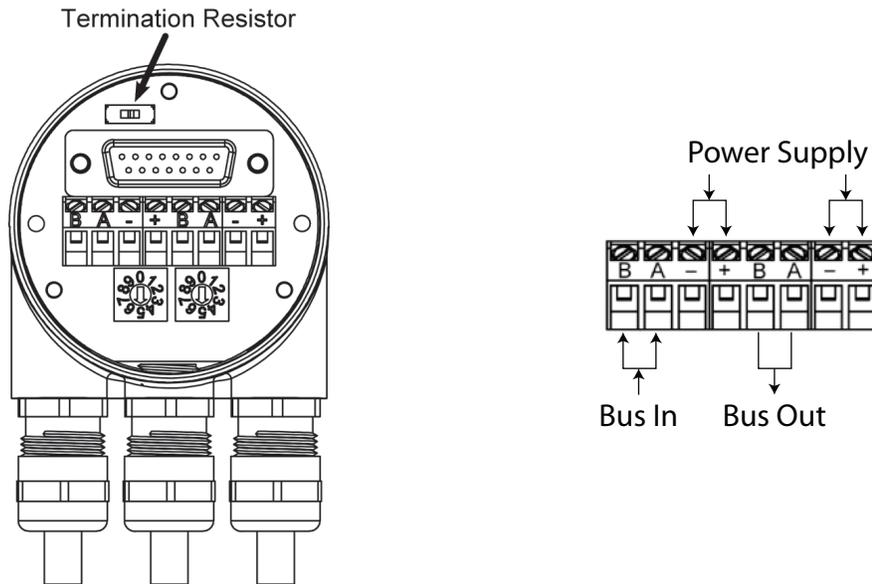
HS6M WIRING DIAGRAMS

Communication Bus "P": Profibus Pinout

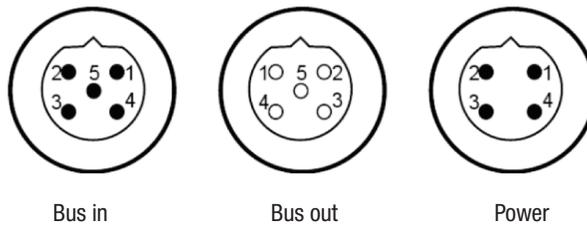


* NOTE: Profibus cabling required. Obey pairing as shown

**If termination resistor "R" is enabled/"on", bus out terminals are disabled

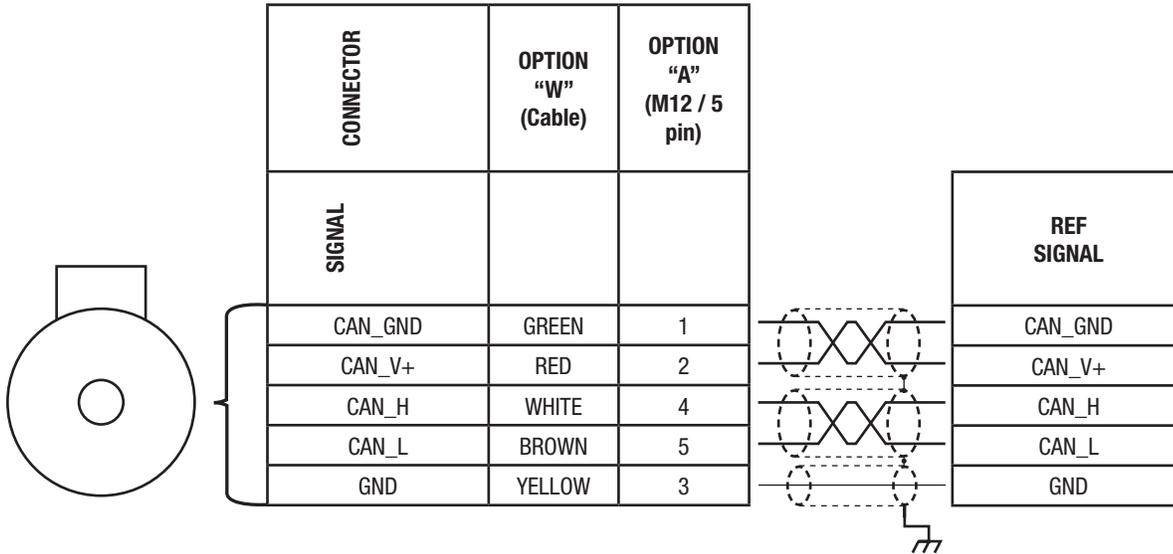


Pinouts for Profibus



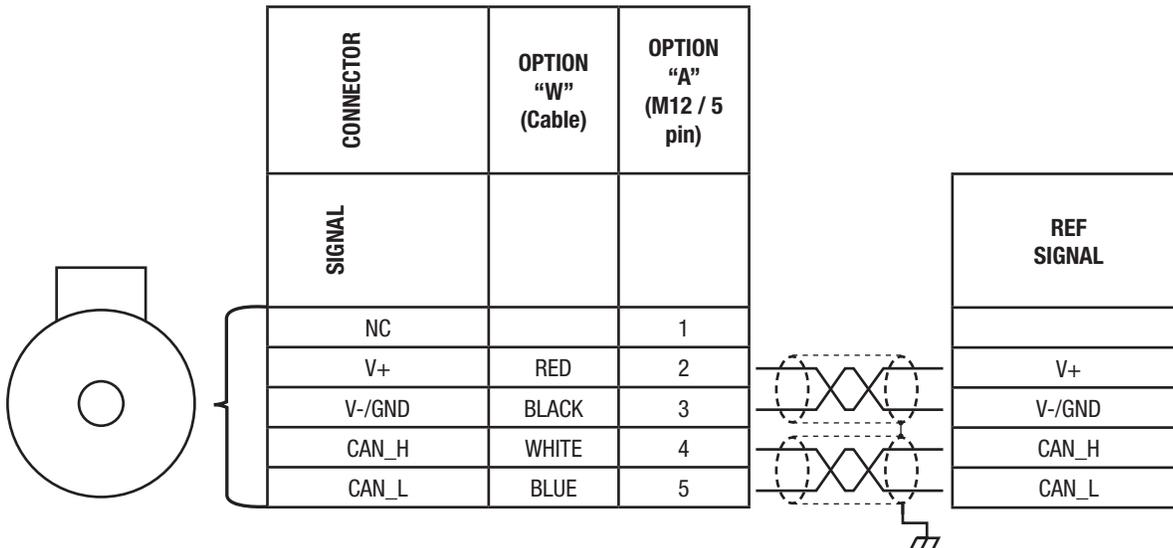
HS6M WIRING DIAGRAMS

CANOpen Bus "C"



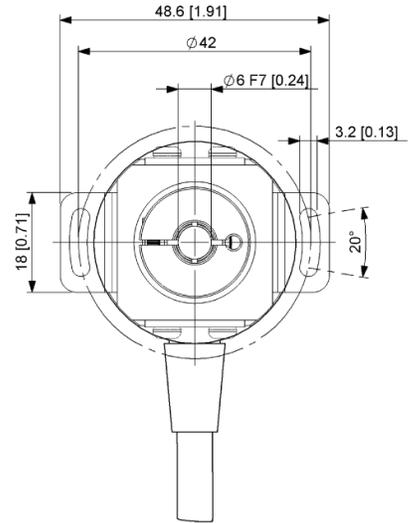
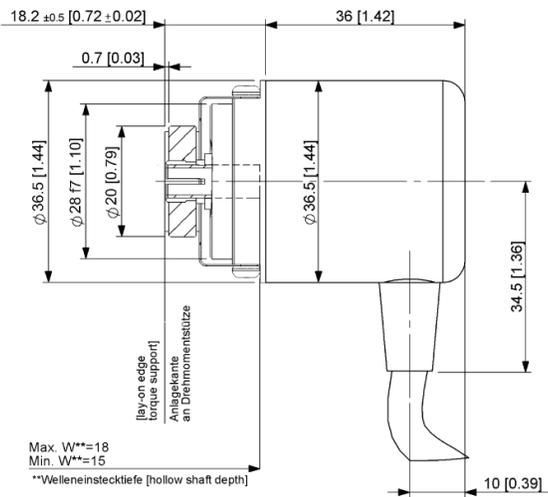
* NOTE: Twisted pair cable required with individual and overall shields. Obey pairing as shown.

DeviceNet Bus "D"



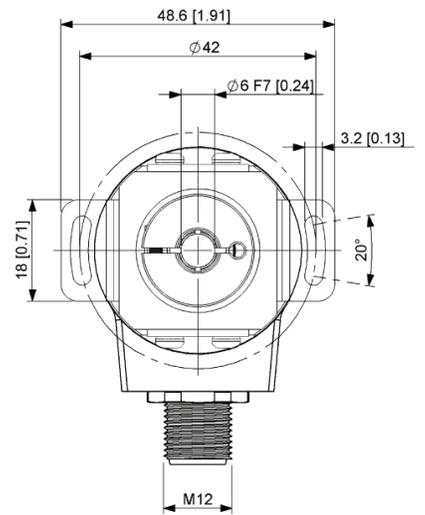
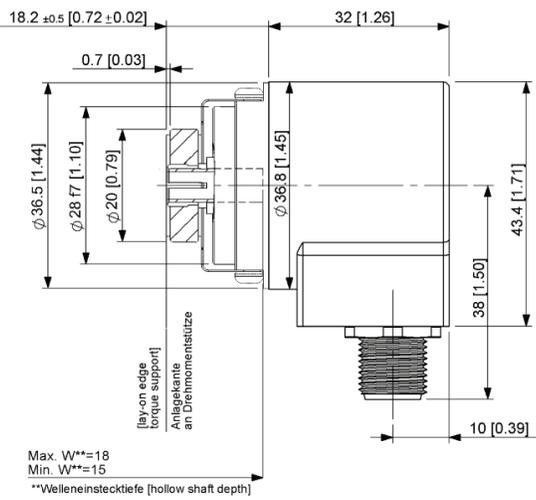
* NOTE: DeviceNet cable required. Obey pinouts and cable pairing as shown.

**HS6M, 36.5mm Housing “3”, Connector/Cable “W”
6mm bore “L”, IP54 Seals & Aluminum+Steel Enclosure “X”**



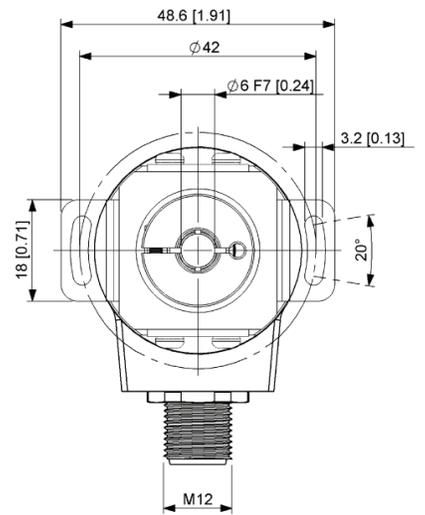
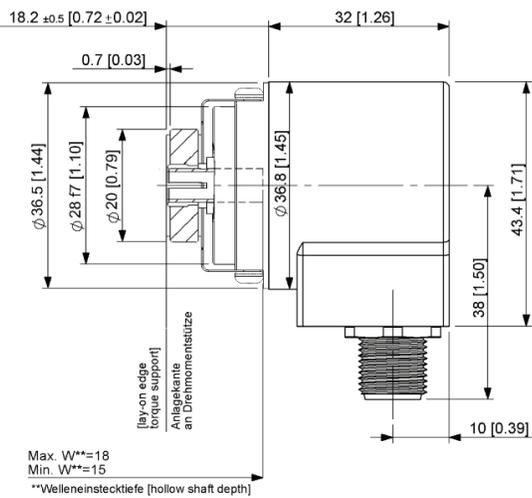
All dimensions are in mm [inches] approx.

HS6M, 36.5mm Housing "3", Connector M12 "A","E" 6mm bore "L", IP65 Seals & Aluminum+Steel Enclosure "A"



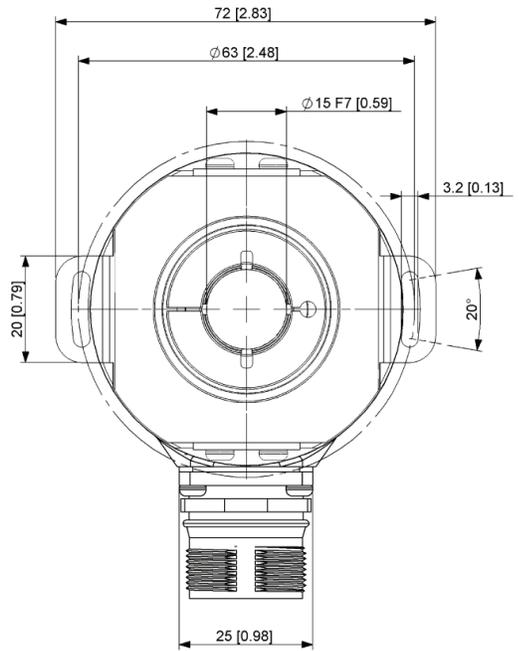
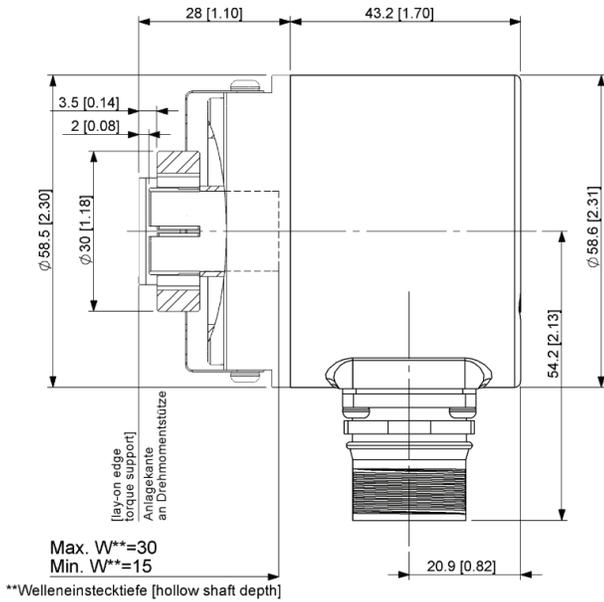
All dimensions are in mm [inches] approx.

**HS6M, 36.5mm Housing “3”, Connector M12 “A”, “E”
6mm bore “L”, IP65 Seals & Aluminum+Steel Enclosure “A”**



All dimensions are in mm [inches] approx.

HS6M, 58mm Housing "1", Connector M23 "F" 15mm bore "R", IP65 Seals & Aluminum+Steel Enclosure "A"



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CE

Features and specifications subject to change without notice.
Avtron standard warranty applies. All dimensions are in mm [inches] approx.

REV: 06/05/15