MTS160D

Magnetic Track Sensor with Position and Angle Reporting

Product Overview

Description

The MTS160D is a cutting-edge magnetic guide sensor designed specifically for mobile robots, offering precise tracking and position measurement capabilities. It is uniquely distinguished by its patented technology for detecting and measuring the angular incidence of a magnetic track, as long as its longitudinal along the horizontal axis. This feature allows the robot to follow its designated paths with higher precision, and to navigate bends at increased speeds without compromising on accuracy or safety.

The MTS160D can serve as the sole guidance sensor in robots that follow fixed paths, offering the lowest cost solution without sacrificing precision or reliability. Alternatively, for robotic systems equipped with laser or vision navigation systems, the MTS160D can be integrated as an additional component to achieve last-millimeter positioning accuracy.

The sensor is optimized for detecting and following paths made with 25mm or 50mm adhesive magnetic tape, or other magnetic sources affixed to the floor. The MTS160D has a 160mm sensing width with a fine 1mm resolution and operates accurately at heights ranging from 10mm to 50mm.

This sensor supports selectable magnetic polarity of the track, allowing for the detection of both North or South polarities on top, and can manage 2-way forks and merges along the path. Additionally, it can detect magnetic "markers" of inverted polarity located on either side of the main track, allowing the robot to distinguish special locations along its path.

For connectivity, the MTS160D is equipped with an M8 4-pin watertight connector for power and signal transmission, and it supports a range of interfaces including CAN bus, RS485 Modbus, and RS232, making it compatible with all PLC brands and microcomputers. It features a built-in, software-enabled 120 ohm termination resistor, and boasts the industry's fastest update rate of 200Hz, ensuring timely and reliable data.

The sensor is also designed for ease of use, with RGB status LEDs for immediate feedback on tape and marker detection, and it comes with a PC utility for simple configuration, testing, and monitoring. Its software can be field-upgraded via the Internet to install the latest features, ensuring the sensor remains at the forefront of technology. An automatic self-test for internal magnetic sensor ICs guarantees consistent performance.

With its compact dimensions of 165 mm in width, 35 mm in depth, and 25 mm in height, and a durable IP54 rated enclosure, the MTS160D is built to operate in a wide range of environments, from -40o to +65o C, and is resistant to water splash. This makes it an ideal choice for a wide array of mobile robotics applications, offering both robustness and advanced technological features to navigate with precision and reliability.

Key Features

- Detects and measures position of up to two magnetic tracks along horizontal axis
- Reports angular position of each track
- Optimized for use with 25mm or 50mm wide adhesive magnetic tape
- 10mm to 50mm operating height
- 160mm sensing width with 1mm resolution
- Selectable, North or South on top, magnetic polarity of track

- Capable of detecting and managing 2-way forks and merges
- Detection of magnetic "markers" of inverted polarity at left or right of main track
- Precise detection along the X & Y axis of one or two magnetic point-sources
- M8 4-pin watertight connector for power and signals
- CANOpen interface up to 1Mbit/s
- Built-in, Software-enabled 120-ohm termination resistor
- RS485 Modbus Interface
- RS232 Interface
- Compatible with all PLC brands and microcomputers
- Industry fastest 200Hz update rate
- RGB Status LEDs for tape and marker detection
- USB port for easy configuration, testing and monitoring using web app on PC or smartphone
- Field upgradeable software for installing latest features via the Internet
- Automatic self-test of internal magnetic sensor ICs
- Wide range 5V to 28V DC operation
- Low, < 1W power consumption
- 165 mm wide x 35 mm deep x 25 mm tall
- -40o to +65o C operating environment
- IP54 rated enclosure. Resistant to water splash

Applications

- Automated Guided Vehicles
- Material Handling Systems
- Automated Manufacturing Lines
- Inventory Management Robots
- Personal Mobility Shuttles
- VNA (Very Narrow Aisle) truck Guidance
- Last-millimeter Positioning for Laser/Vision Guided Robots
- Theatrical Props
- Robotic Camera Dolly
- Smart Agriculture Systems
- Automated Parking Systems
- Interactive Exhibits

Ordering References

Connector and LED Identification

Mounting Holes

M8-4P Power & Communication Connector
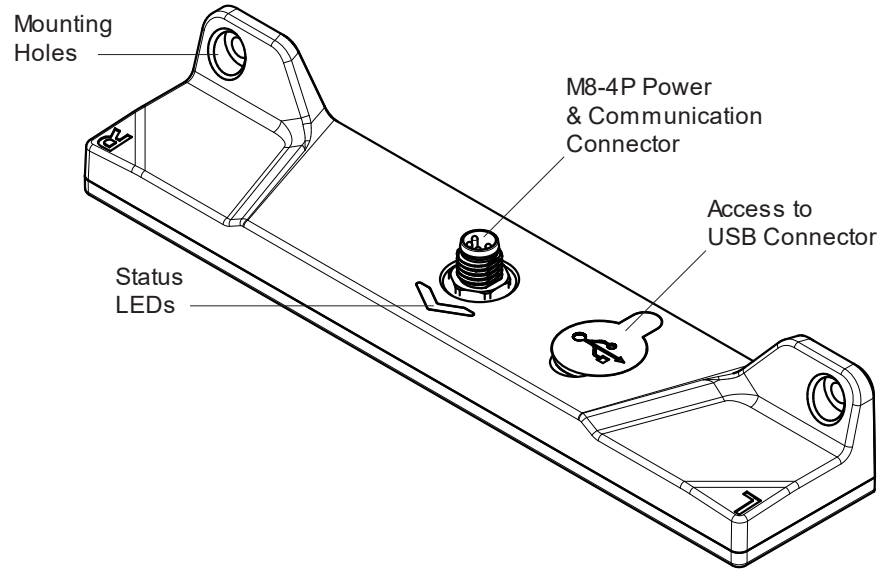
Access to USB Connector

Status LEDs

Figure xx: MTS160D features identification and location

Suitable magnetic materials

The sensor is designed to be compatible with magnetic tape that features a single pole pair (either north or south) with unipolar magnetization on one side, and it can accommodate various magnetic tape widths as well as various distances from the magnetic tape.

The sensor will not work with magnetic tape employing different forms of magnetization, such as alternating magnetization.
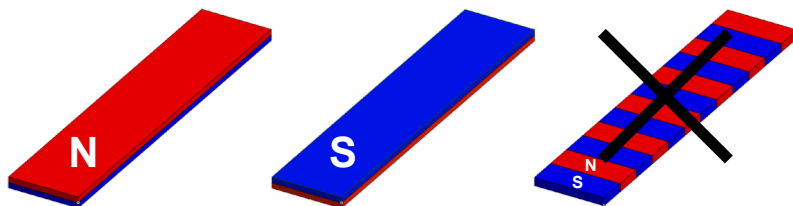

Figure xx: Suitable magnetization.

The figure below showcases various types of magnetic materials that are compatible with the sensor. The field strength and polarity graph above the materials visually indicates the varying magnetic field strength and direction across different points.
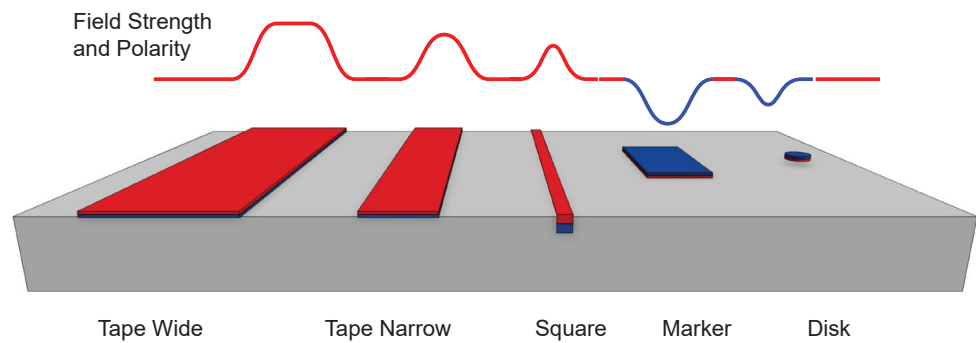
Figure xx: Useable Magnetic Components

Tracking Tape

Use magnetized tape to lay the track for the robot to follow. Tape is available in wide (50mm typical) and narrow (25mm typical) versions. The wider tapes generate a stronger field and have higher adhesion to the floor. The narrow tapes are more cost-effective.

For area where there is high traffic of heavy equipment, flexible magnetic square profile can be inserted into the floor for best durability.

Position Markers

Markers are identical to tracking tape but of inverse polarity. They are used to provides reference locations for the robots along the track.

Point Source Disks

For more precise end-point positioning, the 10mm disks create a localized magnetic source which the sensor can use to align the robot in the X and Y direction.

Sensor Mounting

Left/Right Identification

As a convention, Left and Right sides are relative to the sensor's travel direction that is pointed by the arrow-shaped LED indicator, and are identified with the L and R letters engraved on the case.
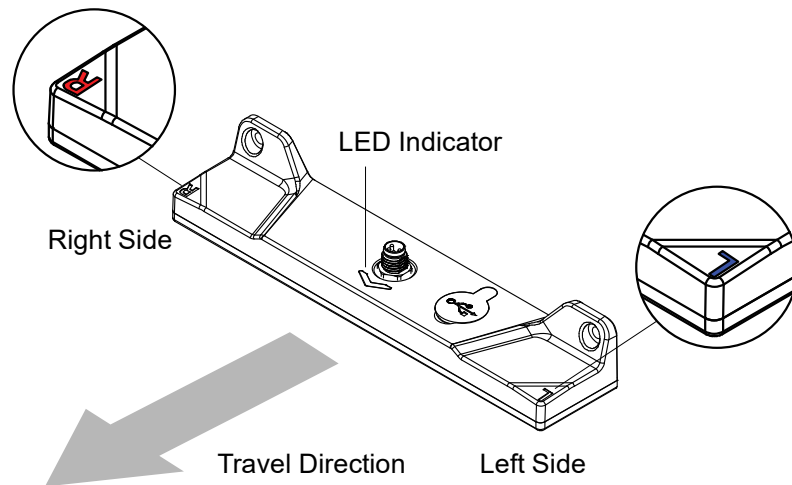

Figure xx: Left/Right sides identification.

Mounting Orientation and Height

The mounting location on the robot must be as free from magnetic disturbance fields as possible.

The sensor must be fitted on the robot so that it is as perfectly parallel to the floor as possible along the length and width direction.

Ideal sensor height is 20mm from the floor.

The sensor must be fitted with the M8 connector facing upward.

For best performance, the sensor must remain at a constant height from the floor as the robot moves along the track.
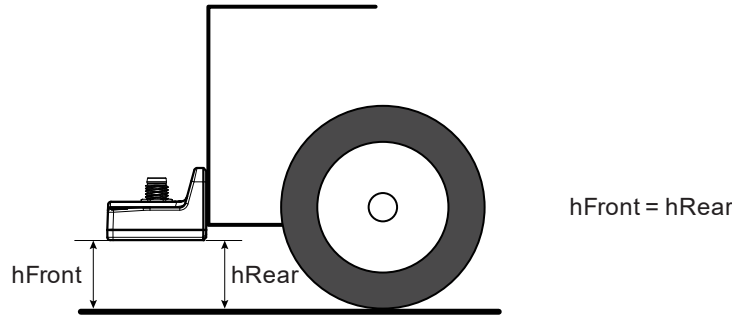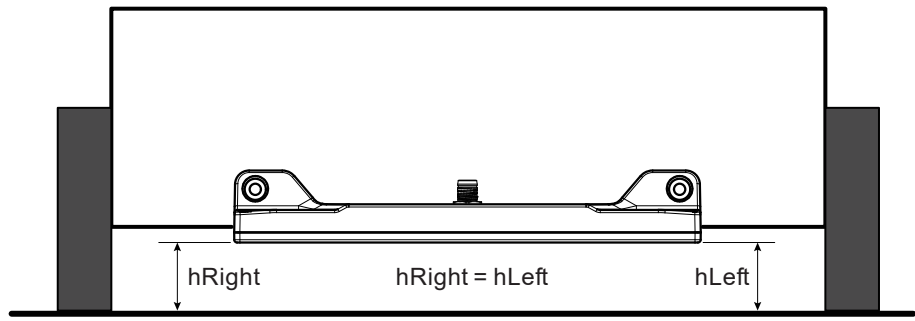
Figure xx: Sensor Mounting location and orientation.

The center point of the sensor should be positioned at the Robot's center point, at a right angle to the direction of travel if possible.
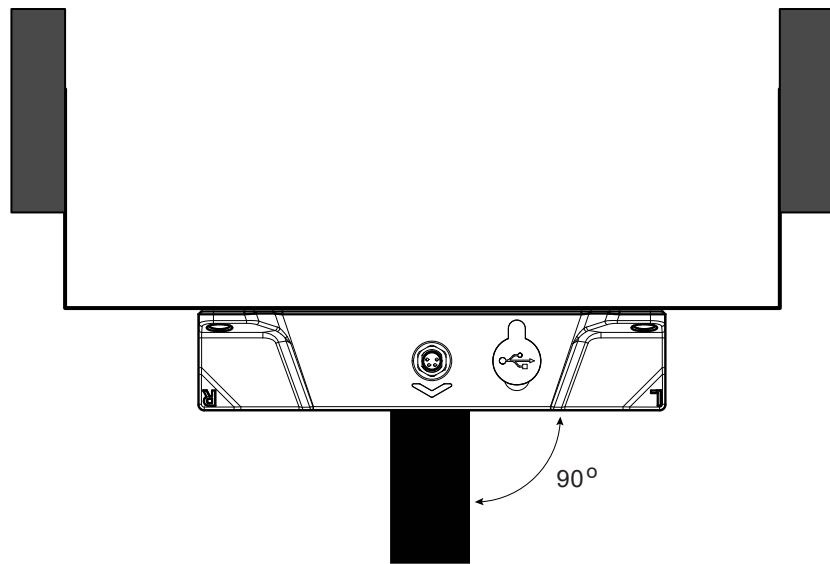

Figure xx: Sensor Mounting location and orientation
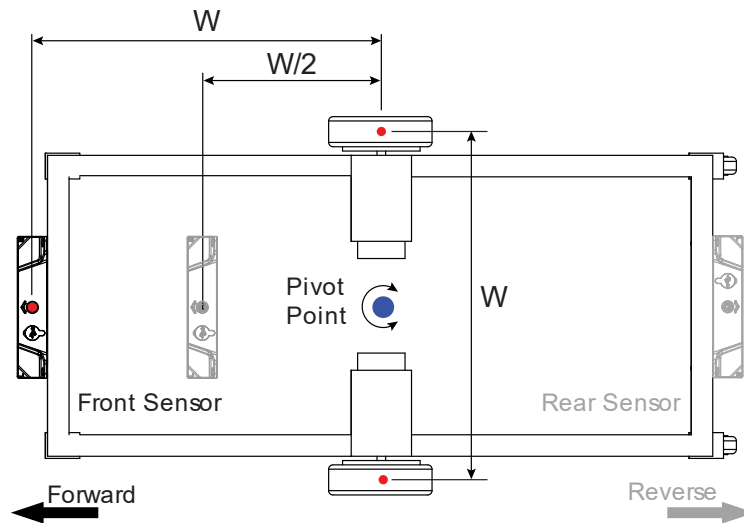
Optimal Position for Steering

Figure xx: Optimal Sensor Placement

For robots using left/right motor-wheel arrangement the sensor must be placed at a distance relative to the wheel spacing W. To ensure that the robot can follow the magnetic path with precision and maintain control, the sensors should preferably be installed at a distance from the pivot point that falls between half the wheel spacing (W/2) and the full wheel spacing (W).

Placing the sensor too close or too far from the pivot points will make it more difficult to achieve stable and precise control.

The sensor must be placed ahead relative to the robot's travel direction. For bidirectional control, sensors must be placed at both the front and rear ends of the robot.

Physical Attachment

To mount the sensor onto the robot, select an accessible area on the robot where the sensor will be attached. Refer to the dimensions indicated in the diagram and measure the spacing for the mounting holes accordingly. The holes for the sensor are spaced 145 millimeters apart.

Position the holes 18.5mm higher than the desired height of the sensor above the floor. Drill two holes at these points that are sized appropriately for M4 screws and are drilled perpendicular to the mounting surface for a level attachment.

Align the sensor over the area, matching its mounting holes with those on the robot. Insert M4 stainless steel screws through the sensor's holes into the robot's holes. Stainless steel is preferred as it avoids the risk of magnetization, which could interfere with the sensor's functionality. Tighten the screws to secure the sensor in place, making sure it's firm but not overly tight to prevent any damage.
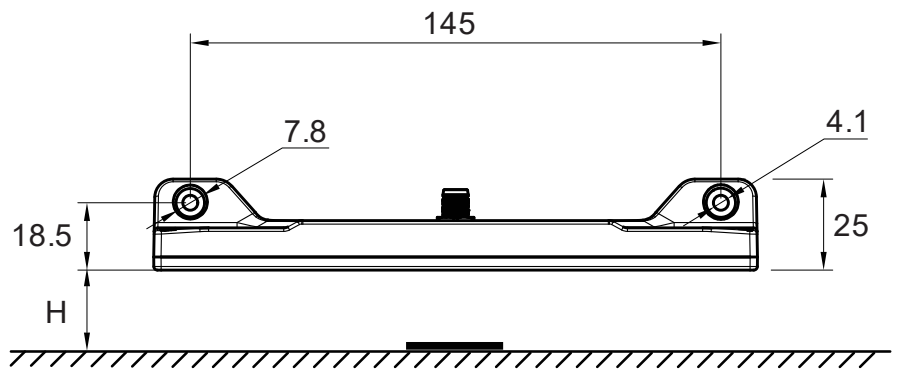
Figure xx: Dimensions for Mounting

Electrical Connections
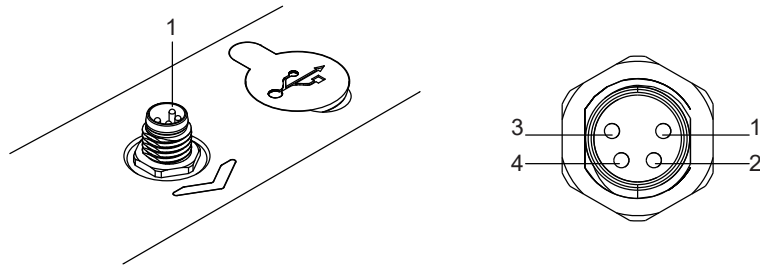
M8 Connector Pin assignment
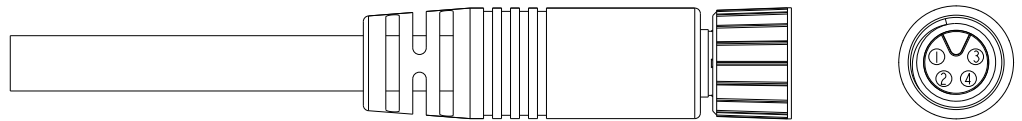
Figure xx: Pin assignment: M8-male, A-coded, 4-pin

Figure xx: Preassembled M8 Cable

Pin Number	Signal	Description	Wire Color
1	VIN+	+5 to +28V Power Supply	Brown
2	CANH/RS232Tx/RS485A	Data Signal 1	White
3	GND	Power Supply Ground	Blue
4	CANL/RS232Rx/RS485B	Data Signal 2	Black

Connecting the supply voltage

The sensor must be connected to a stable voltage supply between 5V and 30 V DC and capable of sourcing at least 2 W power.

Always use the system's main power switch to turn it on or off.

Do not connect the M8 connector while the power is on. Always apply power after the connector is inserted.

Note that when the sensor is connected to a PC or smartphone via the USB port, it will be powered on from these devices if there is no power on the M8 cable.

Data Connections

Data Pin assignment

The MTS160D features a unique multi-interface, multi-protocol communication port that uses only two shared pins or the 4-pin connector. The choice of the protocol and interfaces are software selectable.
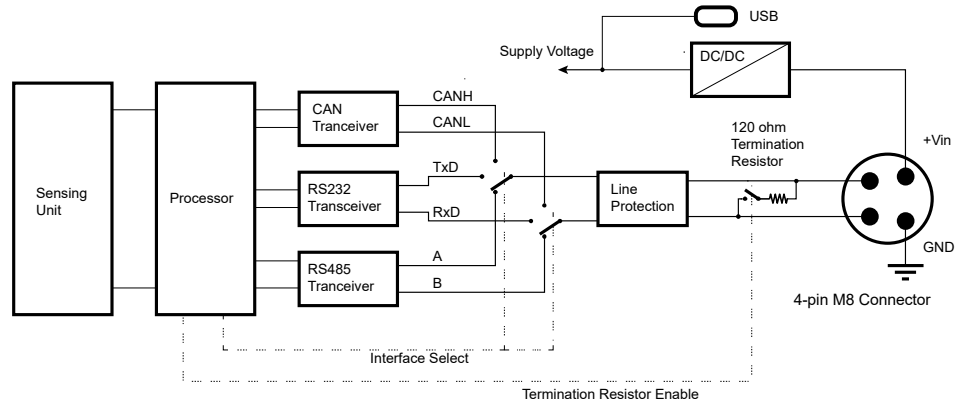
CAN connection

The sensor allows for seamless integration with a CAN network by routing the CAN-High and CAN-Low signals to the two signal pins on the M8 connector.

It includes a built-in 120 Ohm termination resistor that can be activated via the Naviq PC Utility. The resistor is disabled by default.

When the built-in termination resistor is disabled, it is recommended to attach an external 120 Ohm terminator at both ends of the CAN bus network for optimal signal integrity.

RS232 Connection

When RS232 communication is selected, the RS232 Tx (transmit) and Rx (receive) data signals are mapped to the designated pins on the connector.

To establish communication with another RS232 device within the system, connect these two data lines along with the Ground.

RS485 Connection

When RS485 communication is selected, the A (direct) and B (complementary) data signals are mapped to the designated pins on the connector.

To establish communication with other RS485 device(s) within the system, connect these two data lines along with the Ground.

RS485 communication operates in half-duplex mode with 8 data bits, no parity, and one stop bit, with no flow control.

The sensor includes a built-in 120 Ohm termination resistor that can be activated via the Naviq PC Utility. The resistor is disabled by default.

When the built-in termination resistor is disabled, it is recommended to attach an external 120 Ohm terminator at both ends of the RS485 bus network for optimal signal integrity.

USB Connection

The sensor can be directly connected to a PC or Smartphone via its USB C port that is located next to the M8 connector. After plugging in, the sensor will appear to the computer as a Serial Communication port.

The USB port is primarily used together with the Naviq utility for configuring, testing, and tuning the sensor.

While it will operate identically to the RS232 port, it is not recommended to use USB as the main communication interface with the navigation computer.

Preparing the Sensor for Use

The MTS160D is ready for operation with only minimal configuration.

Zero-Level Calibration

The sensor is calibrated at the factory. It may happen that the ambient magnetic level is different at the deployment location. It is therefore recommended to calibrate the sensor's zero level at the final installation. To do so, position the robot away from the track or other magnetic source and issue the zeroing command using the available communication methods or via the PC utility.

Tape Polarity Selection

In its factory default configuration, the sensor is set to detect and follow tracks made of tape with North polarity on the top side, and markers with South polarity on the top side. However, it can be adjusted to work with tape and markers that have the opposite magnetic polarity.

To check the tape's magnetic orientation, tie a strand of thin string around 50-100cm in length to a piece of tape. The tape's north-facing side will naturally align with the Earth's North Pole. As an alternative method, hold a compass against the top (non-sticky) side of the tape. You'll observe that the compass's north-facing needle is drawn towards the tape's south side, while its south-facing needle is drawn towards the north side.

Setting the tape polarity can be done via serial or CAN communication, or via the PC Utility.

Track and Markers Threshold

The MTS algorithm looks for zones of increased magnetic strength to detect tracks, and zones of decreased magnetic strength to detect markers.
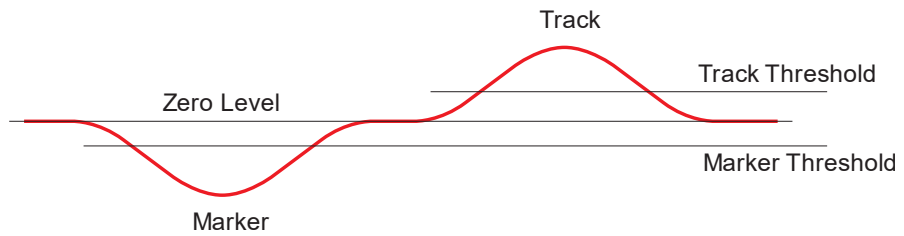
Figure xx : Track and Marker detection thresholds

Communication Mode Selection

The MTS1600D can be configured to operate in the following modes:

- RS232 – Factory Default
- RS485
- SimpleCAN
- CANOpen

The MTS160 supports two distinct CAN communication protocols:

SimpleCAN:

A streamlined protocol delivering fixed frames that contain essential sensor data—such as track position, angle, and status—at a user-determined frequency. SimpleCAN frames are structured in a manner akin to CANOpen PDOs, but do not support SDO or network management capabilities.

CANOpen:

A broadly recognized, industry-standard communication protocol that ensures comprehensive network interaction and interoperability with other CANOpen devices.

RS232 Configuration

RS232 communication is the factory default mode. It operates in full duplex mode with 8 data bits, no parity, and one stop bit, with no flow control. The sensor does not provide an echo for received commands.

Selectable bit rates are:
- 9600 bps
- 19200 bps
- 38400 bps
- 57600 bps
- 115200 bps – Factory default

For compatibility with devices that require TTL-level serial inputs, the RS232 signal levels can be inverted through configuration settings. Default is non-inverted.

To set the RS232 bit rate and the level inversion, use the USB port in conjunction with the Naviq PC utility software.

CAN bus Configuration

Use the USB port in conjunction with the Naviq PC utility software to change the CAN settings.

CAN bus can be configured to operate at any the bit rates below:
- 125kbps
- 250kbps (default)
- 500kbps
- 1Mbps

The sensor's CAN Node ID is user-selectable across the 7-bit range from address 1 to 127.

The sensor's factory default address is 1.

When operating in CAN mode, the sensor will send its measurements inside Process Data Objects (PDOs) at a periodic rate. PDO send rate is user-selectable, from 5 to 1000ms. The factory default is 10ms (100Hz)

All the CAN settings described in this section apply to both SimpleCAN and CANOpen.

It is highly recommended to configure these settings before incorporating the sensor into an active network to prevent potential conflicts or disturbances with other networked devices.

Sensor Data Reporting

The MTS160D measures and reports in real-time several parameters relative to the tracks and position markers. New data is evaluated at 200Hz, or every 5ms.

Permanent Dual Track Detection

The MTS160D always reports data of two tracks simultaneously: One data set for Left and one for the Right track. This happens even if only one track is present. In that case, the data for the Left and Right tracks are identical. This scheme greatly simplifies and improves the handling of merges and forks and is discussed further below.

Track Detection and Strength

The sensor will detect and report the presence of a track and its strength using two bits.

TS1	TS0	Track Detection	Magnetic Strength
0	0	No Track	-
0	1	Track Present	Weak
1	0	Track Present	Medium
1	1	Track Present	Strong

The sensor will operate correctly whenever a track is detected regardless of the magnetic strength. It is however strongly recommended to always have a Medium or Strong level at all locations around the path.

If the magnetic strength is weak, consider lowering the sensor closer to the track, or/and use magnetic tape with higher magnetization.

Lateral Tracks Positions

The sensor reports the lateral position of the tracks relative to the center of the sensor. Values are in millimeters. Positions left of the center are negative values. Positions right of the center are positive values.

Tape Incidence Angles

One of the MTS160D's unique capabilities is the measure of the track's incidence with the sensor. This enables the robot to distinguish between going off track, and therefore the need to apply only small trajectory corrections and entering a curve and therefore needing to apply sustained steering.

The sensor reports the incidence angle of each track with a 1-degree resolution
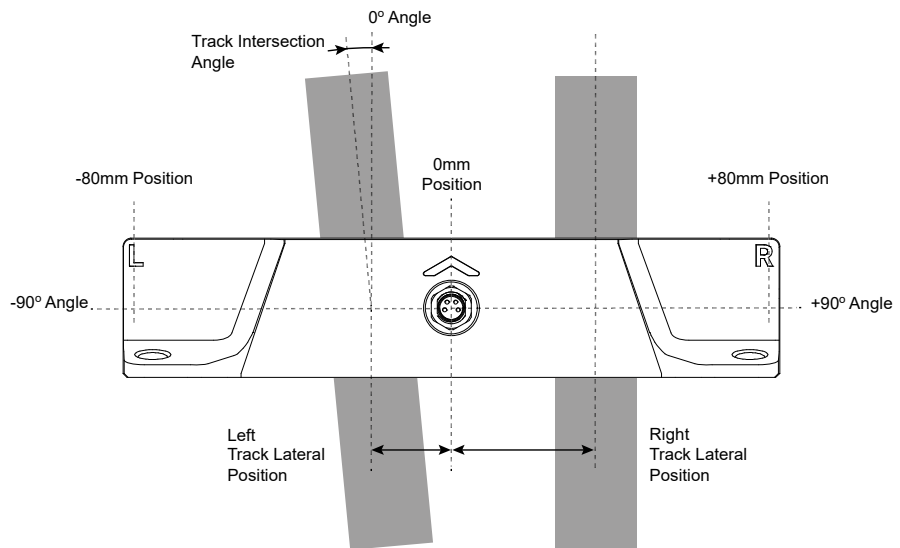

Figure xx : Angle and Lateral Position measurement

The benefits of using the angle and how to use it to optimize track following is discussed in detail further below in the document.

Forks and Merges

The MTS160D supports a very effective forks and merges management technique that ensures precise and smooth, jolt-free, transitions.

It is based on the fact that the sensor always sees two tracks simultaneously, even if only one track is actually present.

When approaching a fork, and the sensor is over a single track, it will report two positions and two angle values. Assuming the robot is perfectly centered and aligned with the track, these will be 0mm and 0 degrees.

When entering the fork, the second track begins to register, and its position and angle is measured and reported. Depending on which branch the robot needs to follow, the navigation computer will use the left or the right track information for steering.

Assuming the left track is followed, the right track information will be ignored as the branches separate.

After the fork is cleared, the sensor only sees a single track again and the left and right values are identical again.

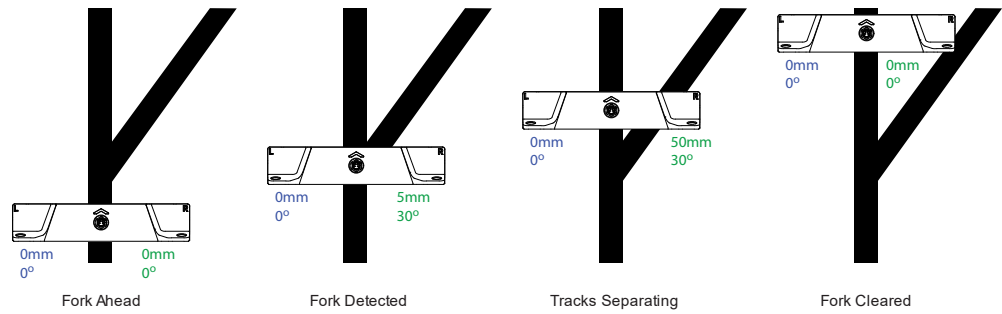| Fork Ahead | Fork Detected | Tracks Separating | Fork Cleared |

Figure xx: Sensor measurements at forks

Merges also use the fact that two position values are reported. Prior to entering a merge, the navigation computer must be set to follow the track that is opposite to this of the incoming branch. In the example below, the robot must be following the left track. As the robot progresses it will suddenly detect the track that is branching from the right, which it will simply ignore until the merge is complete.

Beware that if the robot is set to follow the right track, it will abruptly steer to follow the right track as soon as it is detected.
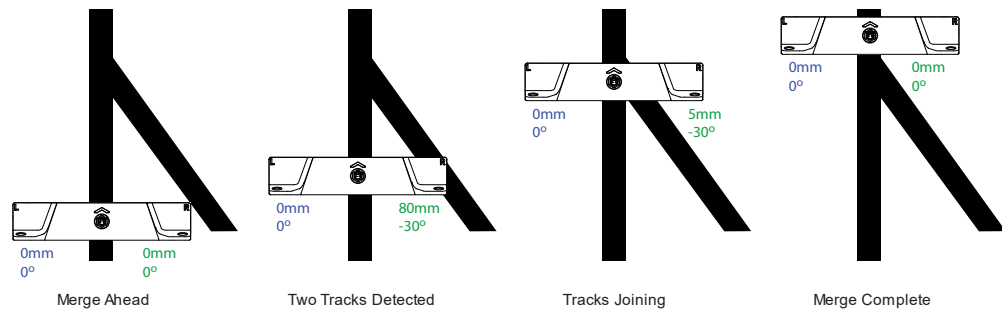

| Merge Ahead | Two Tracks Detected | Tracks Joining | Merge Complete |

Figure xx: Sensor measurements at merges

Left and Right Position Markers

Markers are special bits of magnetic strip that have the opposite polarity to the main track. They are typically used to identify special locations along the robot's path. For instance, markers can indicate a fork ahead in the path, or a merge. They can tell the robot when it's approaching a charging station, or if it needs to adjust its speed, to either pick up the pace or slow down for safety.

The sensor can detect and report the presence of a Left Marker on the left side of the track, or a Right Marker one on the right side. Markers can be combined into patterns to uniquely identify more locations along the track.

Figure xx: Markers Types

It is recommended to use 25mm or longer markers. Markers that are too short will not have enough surface to ensure strong adherence to the floor. Markers shorter than 25mm may also have insufficient magnetic strength.

It is recommended to place the markers so that their edge is 20 to 30mm away from the edge of the main track. The sensor reports the lateral position of markers when detected.

Navicode Coded Markers

The MTS160D is capable of detecting and decoding specially arranged combinations of left and right markers. The coding scheme can encode any number of bits using very simple base patterns for 1 and 0. These can then be concatenated to create multi-bit numbers.
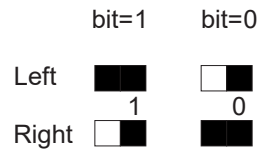

Figure xx: Base patterns for logic levels 1 and 0

The sensor will start the decoding process when a Left or Right marker is detected. The decoding takes place for as long as a marker is present on one side or the other. The decoding ends and value captured when no marker is longer present on either side.
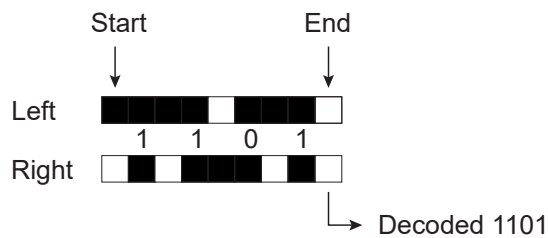

Figure xx: Example of 4-bit Navicode

Navicodes can be from one bit, and up to 16-bit long. When a code is successfully detected and recognized, the sensor will set a flag in the status word. The computer can then send a command to read the code's value.

Last-Millimeter Magnetic Point-Source

Another unique capability of the MTS160 is the detection along the X and Y axis of point-source disk magnets with millimeter accuracy. By installing one such magnet at a precise

known location on each side of the track, it is possible to evaluate the robot's exact position and orientation with very high precision.

This feature makes the sensor a valuable accessory for last-millimeter positioning on robots using laser or vision navigation.

Magnetic disks must be of opposite magnetic polarity than this of the main track. The sensor therefore detects them the same way as markers. In addition, the sensor will report their X and Y position.
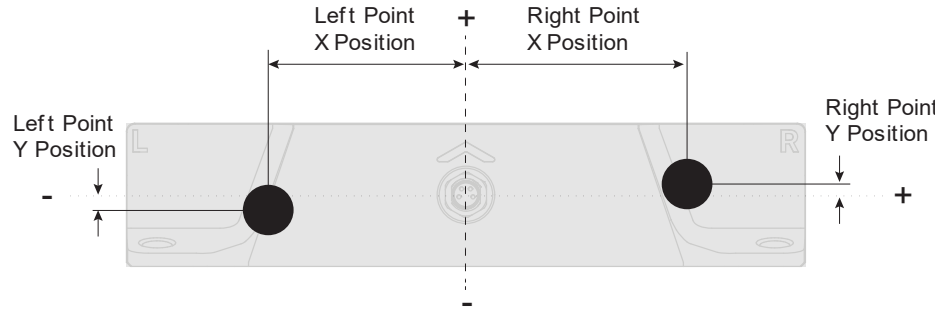

Figure xx: Detection of magnetic point-source

Status LED Flashing Patterns

The MTS has two RGB LEDs behind the arrow-shaped window. It is used to provide visual clues about the state of the sensor and the magnetic elements found within its detection range.
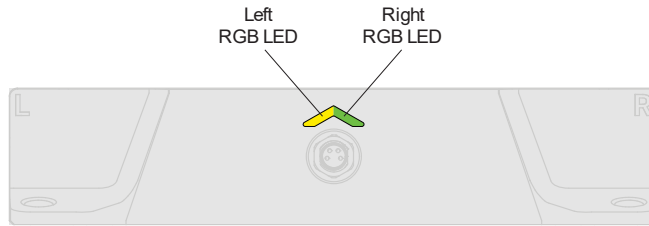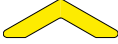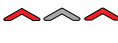

Figure xx: Status LED Indicator

	Track Detect	Left Marker	Right Marker	
	No	No	No	Steady blue indicates that the sensor is in a ready state but not currently engaged with a track and no markers or point-sources are within range
	Yes	No	No	Steady green denotes that the sensor is successfully detecting a magnetic track, but no markers have been identified alongside the track. This indicates the sensor is following the path correctly but is not in proximity to any special markers.
	Yes	Yes	No	Steady green on one half and steady yellow on the other indicates that the sensor is detecting a magnetic track and one marker on one side of the track. The yellow will be lit on the side of the
	Yes	No	Yes	

				marker. This state is used to indicate the detection of additional contextual points on the side of the main path.
	Yes	Yes	Yes	Steady yellow denotes that the sensor is successfully detecting a magnetic track and markers on both sides of the track. This state is used to indicate the detection of additional contextual points on the sides of the main path.
				Steady blue on one half and cyan on the other indicates that the sensor is detecting only one marker and no track. This state is used typically to detect point-source location magnets in non-line following applications
				Steady cyan indicates that that the sensor is detecting markers only, and no track. This state is used typically to detect a pair of point-source location magnets in non-line following application.
	No	No	No	Steady red indicates that the sensor is completely inactive or has encountered a critical error.
	Pattern Dependent			Alternating red and any or the color patterns listed in this table indicates a sensor that failed one or more of its internal self-tests. It may still be operational and output data, however, robot operation must be stopped and the sensor be serviced as soon as possible.

Serial Commands

The MTS supports a set of ASCII text commands that can be exchanged on the RS232 and on the USB port. Commands are not case sensitive.

! Set

Commands starting with the ! character are used to send commands for the sensor to execute or for setting configuration parameters.

Configuration changes are stored in flash upon receiving and remain in effect when power is cycled.

If the command is successfully received without syntax errors, the sensor will reply by repeating the command followed by "OK"

Examples:

Set Zero Level: !ZERO
                             Reply: !ZERO,OK

Set Track Polarity to S on Top: !TPOL 1
Reply: !TPOL,OK

? Get

Commands starting with the ? character are used to request sensor live data, sensor fixed information, or to read configuration parameters. The sensor will reply by repeating the Command name, followed by a coma and the returned data.

Examples:

Get Firmware Revision: ?FWVR
Reply: ?FWVR,106,20240325,2882400018

Get Communication Configuration: ?SNCF
Reply: ?SNCF,50,50

Repeat

@ Stop Repeat

Commands starting with the # character are Get commands identical to these above, except that the sensor will send a reply with new data repeatedly. The repeat rate is determined by a value in milliseconds, separated by a coma, at the end of the command.

Multiple repeat commands can be running at the same time all with their own repeat rate.

Sending the @ character stops all the running repeat commands.

Example:

Get Sensor Values every 10ms: #SALL,10
Repeating reply: ?SALL,0,0,0,0,0,0,0,0,0,0,0,250

Command List

ZERO – Calibrate Zero Level   Category: Set Commands

Description:
Captures and stores the ambient magnetic field strength at each internal sensor when no track or markers are present. Subtracts these values from subsequent reading.

Syntax: !ZERO

Arguments: None

RSET – Rest to Factory Defaults   Category: Set Commands

Description:
Resets all configuration parameters to their factory default values.

Syntax: !RSET

Arguments: None

SALL – Read All Sensor Data   Category: Get Sensor Data

Description:
Read all the sensor's measurements into a single string. Values are coma delimited and determined by their order. An 8-bit counter is sent at the end of the string. The counter increments every time SALL is invoked, either by a new ?Get or #Repeat.

Syntax: ?SALL

Arguments: None

Reply: ?SALL,TDet,LTPos,LTAng,RTPos,RTAng,LM,RM,LMPos,RMPos,Count

1-TDet: Track Detect
    Type: 4-bit   Units: milliTeslas   Range: 0-3

2-LTPos: Left Track Position
3-RTPos: Reft Track Position
    Type: Signed 8-bit   Units: Millimeters   Range +/-80

4-LTAng: Left Track Angle
5-RTAng: Reft Track Angle
    Type: Signed 8-bit   Units: Degrees   Range +/-90

6-LM: Left Marker Detect
7-RM: Right Marker Detect
    Type: bool   Units: -   Range: 0-1

8-LMPos: Left Track Position
9-RMPos: Reft Track Position
    Type: Signed 8-bit   Units: Millimeters   Range +/-80

10-Count: Frame Counter
    Type: unsigned 8-bit   Units: -   Range 0-255

RSEN – Read Internal Sensor Values Calibrated   Category: Get Sensor Data

Description:
Read the value of each of the 32 internal magnetic sensors. Returns value corrected with the zero offset.

Syntax: ?RSEN

Arguments: None

Reply: ?RSEN,Value1,Value2, …,Value32

Value(n)

Type: Signed 16-bit   Units: milliTeslas   Range: +/-16000

RAWS – Read Internal Sensor Values Uncalibrated   Category: Get Sensor Data

Description:
Read the value of each of the 32 internal magnetic sensors. Returns value witout the zero offset correction.

Syntax: ?RAWS

Arguments: None

Reply: ?RAWS,Value1,Value2, ...,Value32

Value(n)
          Type: Signed 16-bit   Units: milliTeslas   Range: +/-16000

STAT –Read Sensor Status   Category: Get Sensor Data

Description: Read the sensors status flags

Syntax: ?STAT

Arguments: None

Reply: ?STAT,Flags
Flags
          Type: Unsigned 8-bit   Units: 0   Range: -

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	Sensor Fault	Track Detect		Left Marker Detect	Right Marker Detect

TPOL – Tape Polarity   Category: Configuration

Description:
Select whether tracking tape has magnetic North or South on top side. Markers setting will also change so that they are opposite polarity than track.

Set Syntax: !TPOL,Polarity

Get Syntax: ?TPOL
Reply: ?TPOL,Polarity

Polarity

0: North on Top
1: South on Top

CMCF – Communication Mode   Category: Configuration

Description:
Select the sensors communication mode and protocol

Set Syntax: !CMCF,Mode

Get Syntax: ?CMCF
Reply: ?CMCF,Mode

Mode
    0: RS232 (Factory Default)
    1: SimpeCAN
    2: CANOpen

RSCF – RS232 Configuration   Category: Configuration

Description:
Defines the parameters necessary for RS232 operation.

Set Syntax: !RSCF,NodeId, Bitrate,TPDOPeriod,TermResistor

Get Syntax: ?RSCF
Reply: ?RSCF,Bitrate,Inverted

Name: baudrate, Type: uint32_t, Description: Baudrate, Options: [9600, 19200, 38400, 57600, 115200]; Name: inverted, Type: uint8_t, Description: Inverted, Options: [0: False, 1: True]

Baudrate
    0: 9600
    1: 19200
    2: 38400
    3: 57600
    4: 115200 (Factory Default)

Inverted – Rx and Tx signal inversion
    0: Not inverted (Factory Default)
    1: Inverted

CNCF – CAN Configuration   Category: Configuration

Description:
Defines the parameters necessary for CANOperation. These parameters are common to SimpleCAN and CANOpen.

Set Syntax: !CNCF,NodeId, Bitrate,TPDOPeriod,TermResistor

Get Syntax: ?CNCF
Reply: ?CNCF,NodeId, Bitrate,Period,TermResistor

NodeId
Type: Unsigned 8-bit   Units: -   Range: 1-127
                                                Default: 1

Bitrate
    0: 125kbits/s
    1: 250kbits/s (Factory Default)
    2: 512kbits/s
    3: 1000kbits/s

Period - TPDO Send Period)
Type: Unsigned 16-bit   Units: milliseconds   Range: 0-65536
                                                      Default: 20

TermResistor - 120 ohm Termination Resistor
    0: Disabled (Factory Default)
    1: Enabled

FWVR – Read Firmware Version   Category: Get Sensor Information

Description:
Read the Firmware revision and date.

Syntax: ?FWVR

Reply: ?FWVR,Revision,Date,FirmwareHash

Revision
    Type: Unsigned 32-bit   Format: 010203 = 1.2.3

Date
    Type: Unsigned 32-bit   Format: YYYYMMDD

FirmwareHash
    Type: Unsigned 32-bit

SNID – Read Sensor Hardware Id   Category: Get Sensor Information

Description:
Read the sensor's unique Hardware Identification number

Syntax: ?SNID

Reply: ?SNID,HardwareId

HardwareId
    Type: Unsigned 32-bit

The EU declaration of conformity can be downloaded from the Internet at: