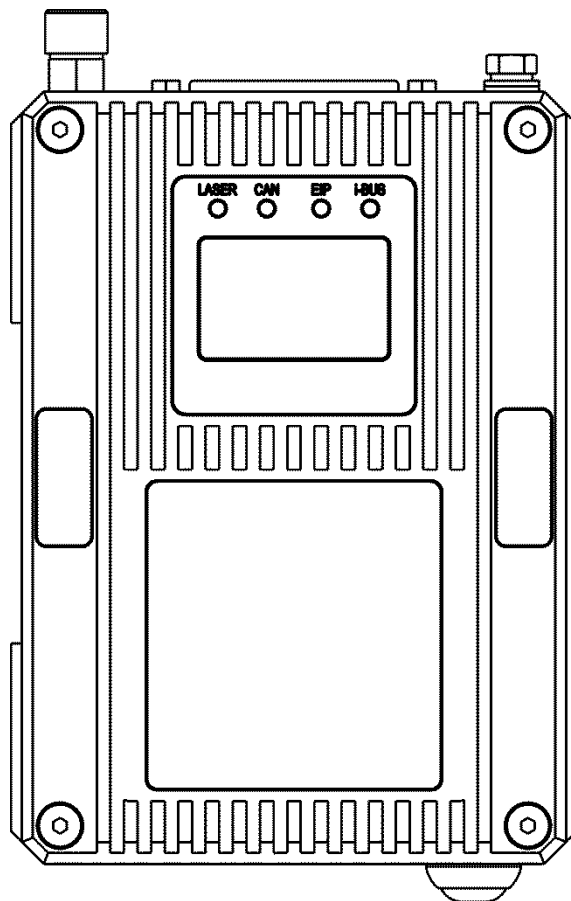


Instruction Manual

SL mini-W and SLR mini-W Series Speed and Length Gauges



Issue 3h
28 December 2022

Proton Products Co. Ltd.
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DECLARATION OF CONFORMITY (CE)

Manufacturer's name: Proton Products International Ltd
Manufacturer's address: 10 Aylesbury End
Beaconsfield
Bucks, UK

EMC Standards Applied: EN 61326-1:2013
Low Voltage Standards Applied: EN61010-1 2010 (Scientific and measuring instruments)

Laser used is 658Nm maximum power output for each beam 20mW (two are emitted from a single source).

Laser Safety Compliance to: BS EN 60825-1:2007
Limitations to use: Heavy Industrial Environment

Compliance with EMC directives was by the standards route.

It is declared for and on behalf of Proton Products Ltd that the equipment specified below conforms to EC directives EMC: 2014/30/EU and Low Voltage: 2014/35/EU and Laser Safety BS EN 60825-1:2007.

Equipment Covered

| Product name | Description | Part number |
|--------------------|---|-------------|
| SL mini 1220-W i4 | Unidirectional non-contact speed and length gauge (stand-off distance: 120mm, depth-of field: 20mm) | 00060MC011 |
| SL mini 3060-W i4 | Unidirectional non-contact speed and length gauge (stand-off distance: 300mm, depth-of field: 60mm) | 00060MC012 |
| SLR mini 1220-W i4 | Bidirectional non-contact speed and length gauge (stand-off distance: 120mm, depth-of field: 20mm) | 00060MC015 |
| SLR mini 3060-W i4 | Bidirectional non-contact speed and length gauge (stand-off distance: 300mm, depth-of field: 60mm) | 00060MC016 |
| PSU-BOB i4 | Break out box for the 25 pin terminal strip on the gauge head combined with power supply | 00060MC050 |
| SiDi-CDi4 | Touch screen display module | 00049MC021 |

These products carry the CE Mark:



The manufacturer of the above named equipment is:

Proton Products International Limited
10 Aylesbury End
Beaconsfield
Bucks
HP9 1LW
ENGLAND

Proton Products is an ISO9001:2015 registered company.

The declaration is signed by:

Paul Sives



DECLARATION OF CONFORMITY (CSA)



This is to certify that the following equipment has been manufactured in compliance with the standards for Machine Safety and Workplace Electrical Safety according to the CSA (Canadian Standards Association).

Equipment Covered

| Product name | Description | Part number |
|--------------------|--|-------------|
| SL mini 1220-W i4 | Unidirectional non-contact speed and length gauge (stand-off distance: 120mm, depth-of field: 20mm) | 00060MC011 |
| SL mini 3060-W i4 | Unidirectional non-contact speed and length gauge (stand-off distance: 300mm, depth-of field: 60mm) | 00060MC012 |
| SLR mini 1220-W i4 | Bidirectional non-contact speed and length gauge (stand-off distance: 120mm, depth-of field: 20mm) | 00060MC015 |
| SLR mini 3060-W i4 | Bidirectional non-contact speed and length gauge (stand-off distance: 300mm, depth-of field: 60mm) | 00060MC016 |
| PSU-BOB i4 | Break out box for the 25 pin terminal strip on the gauge head combined with power supply | 00060MC050 |
| SiDi-CDi4 | Touch screen display module | 00049MC021 |

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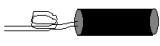
Paul Sives



LASER SAFETY PARAMETERS

**VISIBLE AND INVISIBLE LASER RADIATION
AVOID EYE OR SKIN EXPOSURE TO
DIRECT OR SCATTERED RADIATION
CLASS IIIb LASER PRODUCT**

**CAUTION - LASER RADIATION WHEN OPEN,
DO NOT STARE INTO BEAM OR VIEW DIRECTLY
WITH OPTICAL INSTRUMENTS**



**AVOID EXPOSURE - Laser
radiation emitted from
this aperture**

Proton Products SL mini-W and SLR mini-W series laser speed and length gauges emit laser radiation with the following parameters:

| Parameter | Minimum | Typical | Maximum | Units |
|---|-----------|---------|---------|--------------------|
| Wavelength | 650 | 658 | 670 | nm |
| Beam diameter | | | 3 | mm |
| Spot size at standoff distance | | | 3 | mm |
| Beam divergence | | | 1.5 | mrad |
| Total emitted power | | | 40 | mW |
| Emitted power per beam (2 beams are emitted) | | | 20 | mW |
| Power density at gauge window | | | 280 | mW/cm ² |
| Power density at standoff distance | | | 560 | mW/cm ² |
| Nominal hazard zone (NHZ) distance (diffuse surface reflection)* | 20 to 100 | | | mm |
| Nominal hazard zone (NHZ) distance (specular / reflective surface reflection) | 150 | | | m |

*this distance is highly dependent on the nature and type of diffuse surface.

This product complies with DHHS Rule 21 CFR chapter I subchapter J in effect at date of manufacture.
This item complies with 21 CFR 1040.10 and 1040.11.
Manufacturer: Proton Products International Ltd.
Address: 10 Aylesbury End Beaconsfield Buckinghamshire HP9 1LW England.

Manufacturer signature:

Paul Sives: 

Proton Products is an ISO9001:2015 registered company.



INTRODUCTION

The Proton Products SL mini-W and SLR mini-W series of laser speed and length gauges provide highly-accurate, non-contact speed and length measurement.

SL mini-W series gauges offer speed and length measurement for unidirectional production lines.

SLR mini-W series gauges offer speed and length measurement for bidirectional production lines. The gauge senses the direction of motion and will automatically increment or decrement the length accordingly. SLR mini-W gauges are thus suitable for production lines that undergo direction reversals or stationary (zero speed) periods.

Compared to traditional contact wheel encoders, SL mini-W / SLR mini-W non-contact speed and length gauges offer the following advantages:

- Capable of measurement at much higher speeds and accelerations
- No slippage
- Greater accuracy
- No wear or damage to the measured object
- Solid state design results in higher reliability and MTBF

RS-232, RS-422, RS-485, Ethernet, industrial standard communication interfaces (PROFIBUS, EtherNet/IP or PROFINET) and WiFi communication interfaces are installed as standard for straightforward connection to computers or PLCs.

User configurable digital inputs are provided as standard to reset gauge measurements and trigger printing. User configurable digital outputs are provided as standard to signal gauge status and preset length reached.

PRINCIPLE OF OPERATION

SL mini-W series unidirectional speed and length gauges illuminate the measured surface with a precisely pitched interference pattern created by the intersection of two laser beams. The alternating bright and dark interference fringes modulate the light scattered by the object with a frequency proportional to the object speed. This scattered light is detected by a photodiode and the electrical signal digitally processed to determine the frequency and hence the speed. Object length is then calculated by integrating the speed measurement over time.

SLR mini-W series bidirectional speed and length gauges extend this principle by using a high-frequency Bragg cell modulator to illuminate the measured surface with a scanning interference pattern, which generates an oscillating light signal even when the object is stationary. Direction of motion is determined by whether the scattered light frequency is higher or lower than the stationary frequency.

PRINCIPLE OF OPERATION

$$d = \frac{\lambda}{2 \sin \kappa}$$

- Fringe spacing is a function of laser wavelength and beam angle.

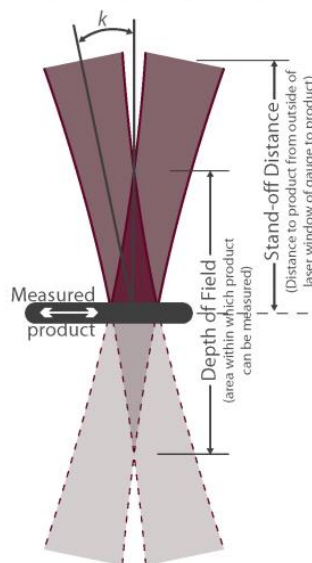
$$f \propto \frac{v}{d}$$

- Doppler frequency is proportional to speed and inversely proportional to fringe spacing.

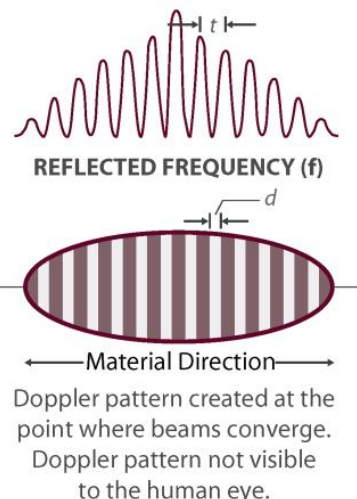
$$L = \int_0^T v dt$$

- Speed is integrated to measure length.

LASER BEAMS: SIDE VIEW



LASER DOPPLER PATTERN



SPECIFICATIONS

MODEL-SPECIFIC SPECIFICATIONS

| Specification | Unidirectional – SL mini-W | | Bidirectional – SLR mini-W | | Units |
|----------------------------|----------------------------|------|----------------------------|-------|-------|
| | 1220 | 3060 | 1220 | 3060 | |
| Minimum speed | 0.15 | 0.25 | 0 | 0 | m/min |
| Maximum speed | 2000 | 3000 | ±2000 | ±3000 | m/min |
| Nominal stand-off distance | 120 | 300 | 120 | 300 | mm |
| Depth of field | 20 | 60 | 20 | 60 | mm |

COMMON SPECIFICATIONS

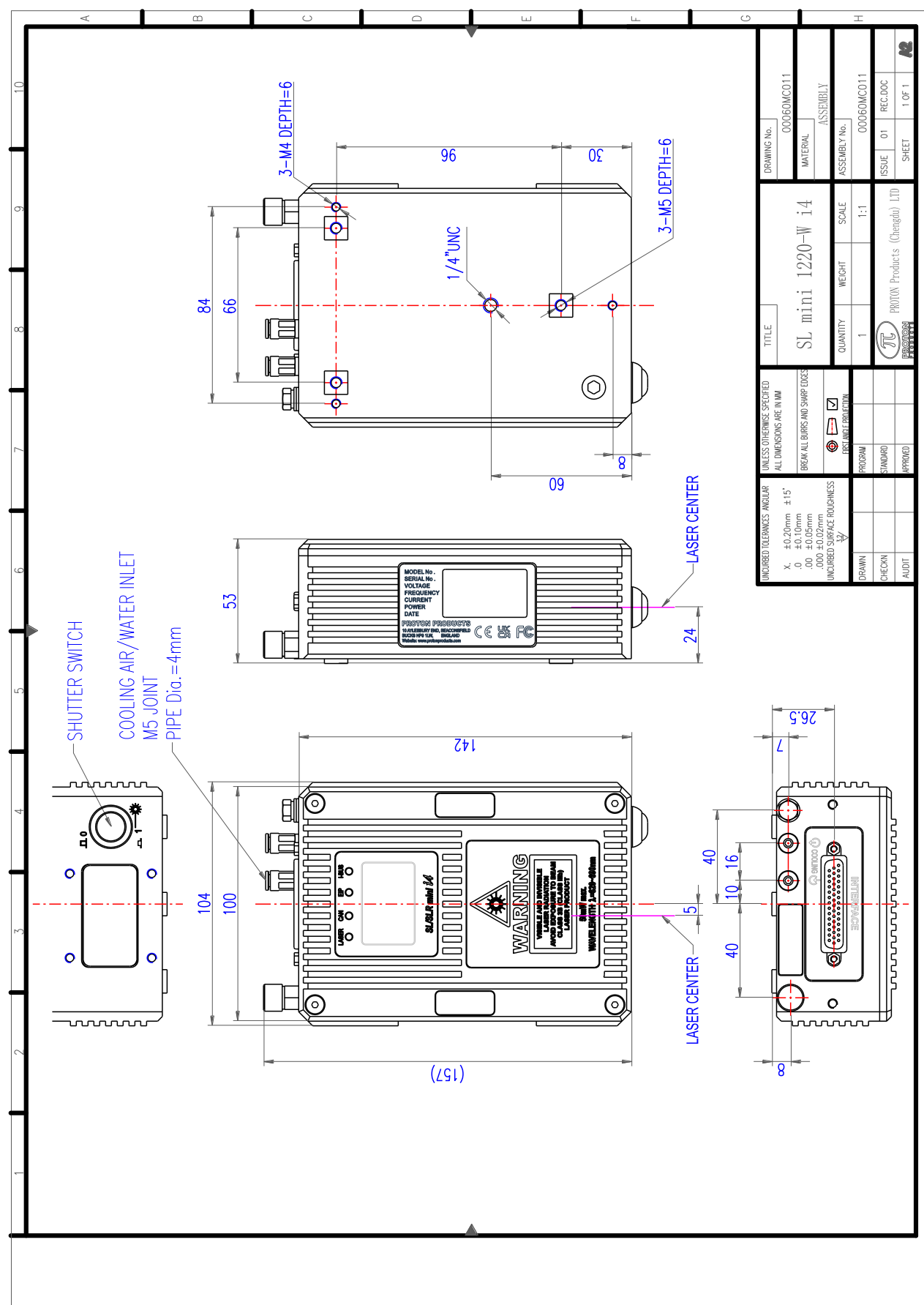
| Specification | Minimum | Typical | Maximum | Units |
|--------------------------|---|---------|----------------------|------------------|
| Accuracy | -0.05 | | 0.05 | % |
| Repeatability | -0.02 | | 0.02 | % |
| Acceleration | | | 500 | m/s ² |
| Measurement update time | | | 40 | μs |
| | | | | |
| Laser beam diameter | | | 3 | mm |
| Laser classification | | | 3B | - |
| | | | | |
| Operating temperature | +5 | | +40 | °C |
| Environmental protection | | | IP67 | - |
| | | | | |
| Power supply voltage | 18 | 24 | 30 | VDC |
| Power consumption | | | 15 | W |
| | | | | |
| Length | | | 142 | mm |
| Width | | | 104 | mm |
| Height | | | 53 | mm |
| Measurement display | Integrated backlit LCD | | | |
| Pulse outputs | 3× RS-422 compliant differential pair outputs with maximum pulse rate 2 MHz (cable length dependent), end-user configurable as: | | | |
| | 6× independent pulse outputs | | 3× quadrature output | |
| Laser safety | Laser enable input | | Open shutter input | |
| | Shutter status output | | | |
| | Reverse Direction | | Length Hold | |

| | | | |
|--|--|----------|-----------------|
| 3× Logic inputs (end-user configurable functions) | Reset | | Speed Hold |
| | End of Reel | | Display Hold |
| 2× Logic outputs (end-user configurable functions) | Gauge OK | | Gauge too hot |
| | Good reading | | Object detected |
| | Preset length 1 / Batch length reached | | |
| | Preset length 2 / Batch number reached | | |
| | Gauge measuring speed | | |
| Standard communications interfaces | RS-232* | | CANbus** |
| | Ethernet TCP/IP (Modbus protocol), WIFI, OPC UA. | | |
| | PROFIBUS | PROFINET | EtherNet/IP |

*An optional RS-232-to-USB converter cable is available for connection to USB equipped computers.

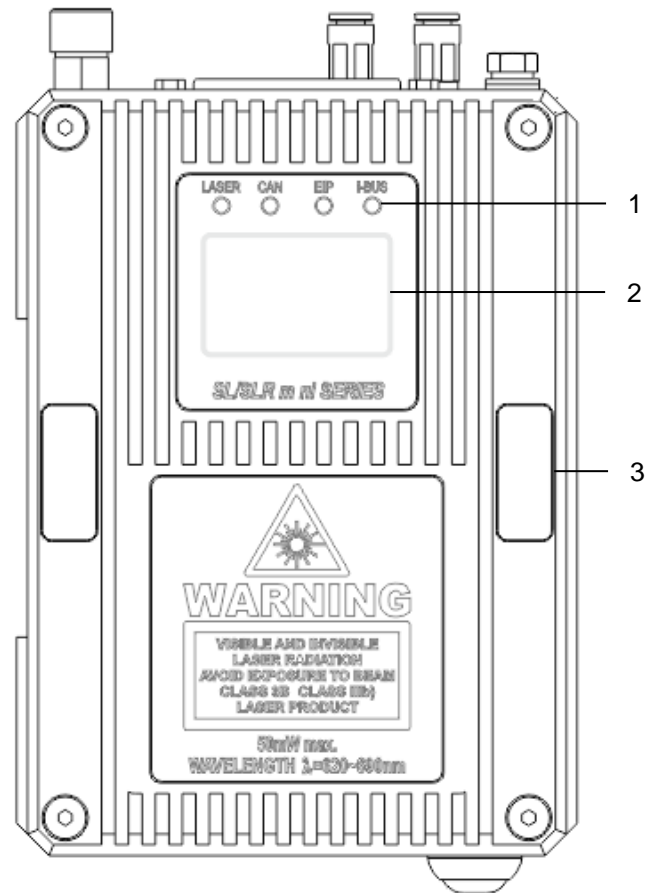
**CAN-bus protocol is proprietary and reserved for connection to other Proton Products equipment such as a CDI4 interface display unit.

DIMENSIONAL DRAWINGS



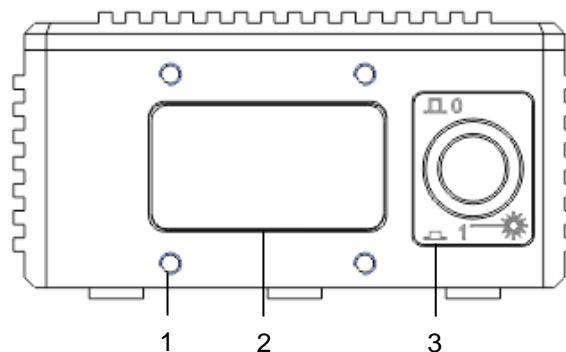
ANNOTATED DRAWINGS

TOP VIEW



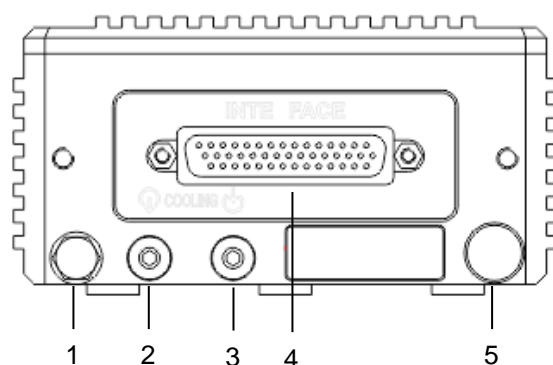
| Label | Description |
|-------|---|
| 1 | LED indicators |
| 2 | LCD display |
| 3 | Tamper-evident seal (x2; damage to or removal will invalidate the product warranty) |

FRONT VIEW



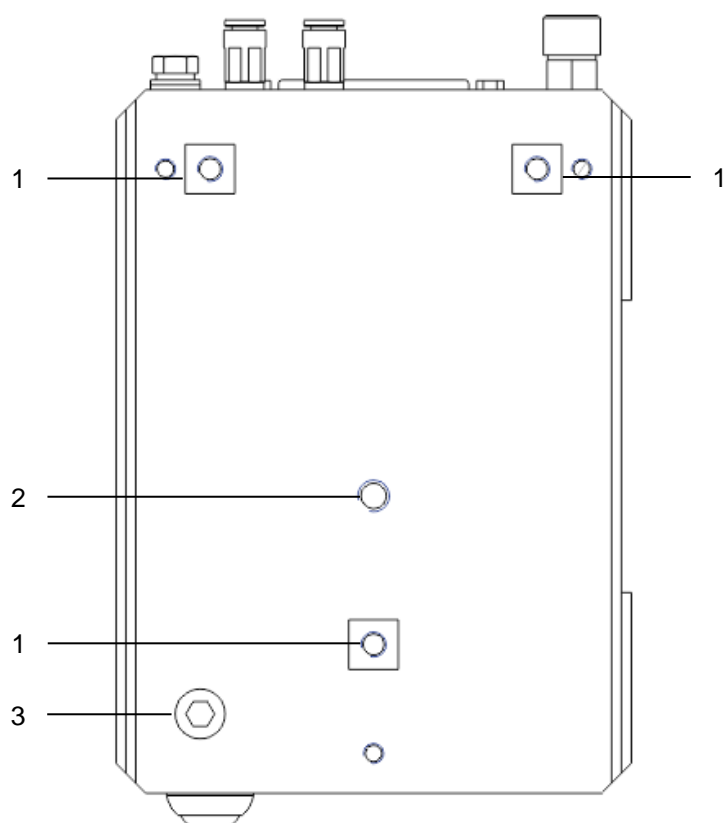
| Label | Description | | |
|-------|---|----------------------|-------------------|
| 1 | Optional air wipe / beam enclosure tube mounting holes (x4) | | |
| 2 | Optical window | | |
| 3 | Laser shutter control switch | | |
| | Switch status | Laser shutter status | Laser beam status |
| | Out | Closed | Blocked |
| | In | Open | Emitting |

REAR VIEW



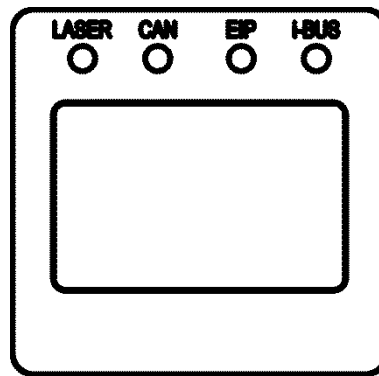
| Label | Description |
|-------|--|
| 1 | Earth bolt |
| 2 | Cooling air / water outlet |
| 3 | Cooling air / water inlet |
| 4 | "INTERFACE" connector port |
| 5 | Nitrogen gas purge port (for factory use only; any attempt to open or connect to this port will invalidate the product warranty) |

UNDERSIDE VIEW



| Label | Description |
|-------|--|
| 1 | M5 threaded mounting hole (x3) |
| 2 | 1/4"-20 UNC threaded tripod mounting hole |
| 3 | Nitrogen gas purge port (for factory use only; any attempt to open or connect to this port will invalidate the product warranty) |

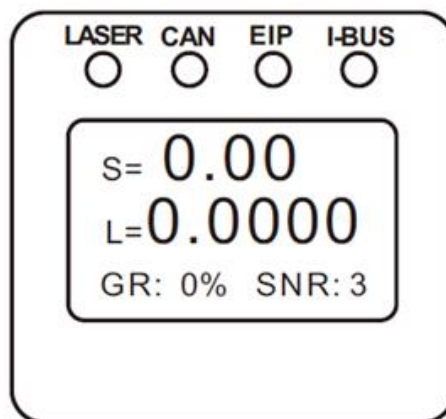
LED INDICATORS



| Label | Condition | Description |
|-------|--------------|--|
| LASER | Extinguished | No laser emission |
| | Yellow | Laser emission |
| | Flashing | Laser shutter is closed, whilst laser diode is on. |
| CAN | Extinguished | No CANbus connection |
| | Green | CANbus communicating |
| EIP | Extinguished | No Ethernet connection |
| | Green | Ethernet connected |
| | Flashing red | Ethernet data transmission |
| i-BUS | Extinguished | Optional PROFIBUS / PROFINET / EtherNet/IP not connected |
| | Green | Optional PROFIBUS / PROFINET / EtherNet/IP connected |

ON-GAUGE LCD DISPLAY


The SL mini-W and SLR mini-W gauges are fitted with a backlit, on-gauge LCD which displays the following information:




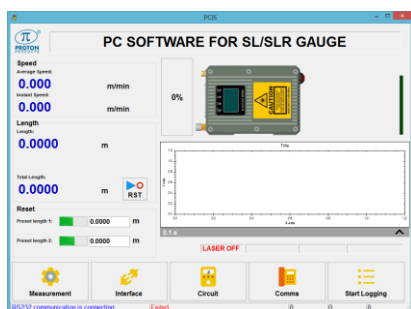
| Label | Description |
|-------|--------------------------|
| S | Measured speed |
| L | Measured length |
| GR | Good Readings percentage |
| SNR | Signal-to-Noise Ratio |

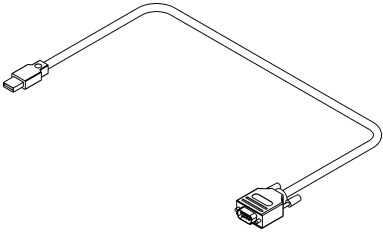
OPTIONAL ACCESSORIES

COMMUNICATIONS

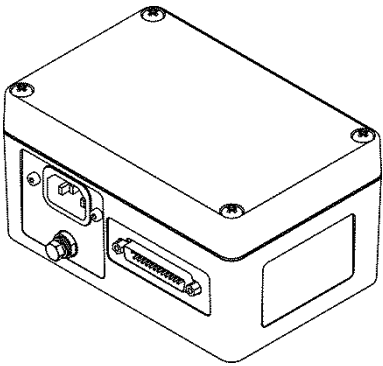
| | |
|--|---|
| <div>SiDi-CDi4-SL</div> <div></div> | <div>Touch screen display module</div> <div><ul style="list-style-type: none">• Touch screen display.• Connects via the CAN-bus port.• Displays measured speed and length.• Provides menu-based setting of all parameters.• Mounts directly on the gauge body or remotely via an extension cable.</div> |
| Proton part number | 00049MC021 |

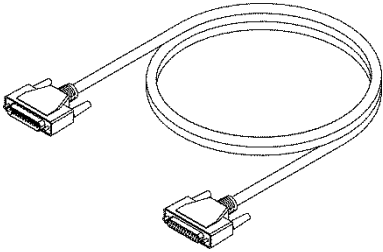
| <div>CAN-bus cable</div> <div></div> | <table><tr><th>Name</th><th>Length / m</th><th>Proton part number</th></tr><tr><td>CAN 9DD_003M</td><td>3</td><td>00041CB003</td></tr><tr><td>CAN 9DD_005M</td><td>5</td><td>00041CB005</td></tr><tr><td>CAN 9DD_010M</td><td>10</td><td>00041CB010</td></tr><tr><td>CAN 9DD_020M</td><td>20</td><td>00041CB020</td></tr><tr><td>CAN 9DD_030M</td><td>30</td><td>00041CB030</td></tr><tr><td>CAN 9DD_040M</td><td>40</td><td>00041CB040</td></tr></table> | Name | Length / m | Proton part number | CAN 9DD_003M | 3 | 00041CB003 | CAN 9DD_005M | 5 | 00041CB005 | CAN 9DD_010M | 10 | 00041CB010 | CAN 9DD_020M | 20 | 00041CB020 | CAN 9DD_030M | 30 | 00041CB030 | CAN 9DD_040M | 40 | 00041CB040 |
|--|---|--------------------|------------|--------------------|--------------|---|------------|--------------|---|------------|--------------|----|------------|--------------|----|------------|--------------|----|------------|--------------|----|------------|
| Name | Length / m | Proton part number | | | | | | | | | | | | | | | | | | | | |
| CAN 9DD_003M | 3 | 00041CB003 | | | | | | | | | | | | | | | | | | | | |
| CAN 9DD_005M | 5 | 00041CB005 | | | | | | | | | | | | | | | | | | | | |
| CAN 9DD_010M | 10 | 00041CB010 | | | | | | | | | | | | | | | | | | | | |
| CAN 9DD_020M | 20 | 00041CB020 | | | | | | | | | | | | | | | | | | | | |
| CAN 9DD_030M | 30 | 00041CB030 | | | | | | | | | | | | | | | | | | | | |
| CAN 9DD_040M | 40 | 00041CB040 | | | | | | | | | | | | | | | | | | | | |

| | |
|--|---|
| <div>PCiS_SL/SLR mini</div> <div></div> | <div>PC Interface Software</div> <div><ul style="list-style-type: none">• PC-based software package.• User-friendly graphical user interface.• Displays all measurements.• Provides menu-based setting of all parameters.• Provides trending, data logging, presets and alarms.• Gauge to PC connection via RS-232 or Ethernet</div> |
| Proton part number | 00060SW001 |

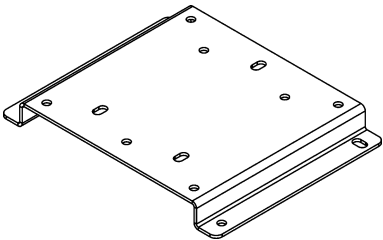
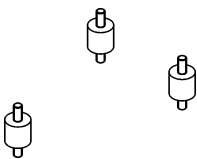
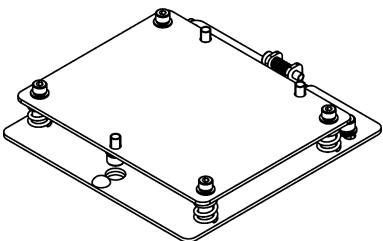
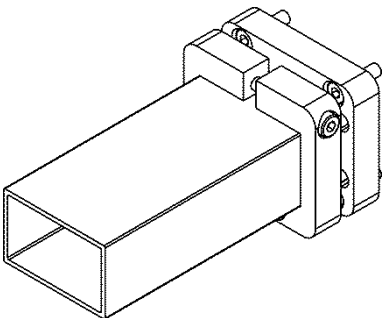
| | |
|---|--|
| USB-RS232 Cable | |
|  | <ul style="list-style-type: none"> • For connecting the RS232 port of the PSU-BOB to the 7" Touch Screen PC. • Length: 1.8m. |
| Proton part number | GP00000624 |

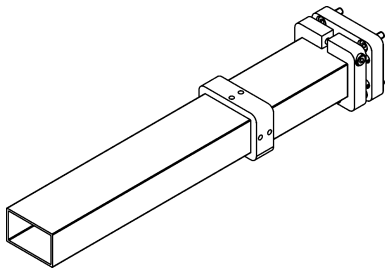
POWER

| | |
|--|--|
| PSU-BOB | Power supply and mini break out box |
|  | <ul style="list-style-type: none"> • Connects via the DB44 "INTERFACE" connector. • Supplies 24VDC electrical power to the gauge. • Provides screw terminal access to all electrical interfaces. • Provides DB9 connectors for access to the CANbus, RS232 and industrial bus communications interfaces. • Provides a RJ45 socket for the Ethernet interface. • End user cables are sealed with three cable glands. • Input voltage range: 90 – 260 VAC @ 45 – 65 Hz. • Select the required length of DB44 cable from below. |
| Proton part number | 00060MC050 |

| DB44 "INTERFACE" port to PSU-BOB cable | | | |
|---|------------------------|------------|--------------------|
|  | Name | Length / m | Proton part number |
| | DB44_003m(9.8ft) Cable | 3 | 00053CE001 |
| | DB44_005m(16ft) Cable | 5 | 00053CE002 |
| | DB44_010m(32ft) Cable | 10 | 00053CE003 |
| | DB44_020m(64ft) Cable | 20 | 00053CE004 |
| | DB44_030m(98ft) Cable | 30 | 00053CE005 |

STANDS AND GUARDS

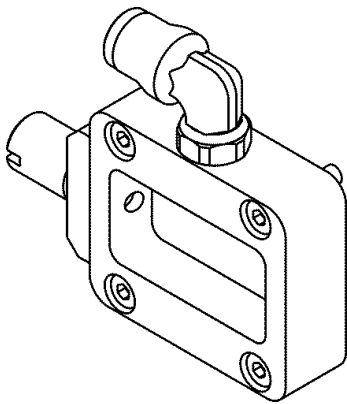
| | |
|---|--|
| Base Plate | |
|  | <ul style="list-style-type: none"> For securing a SL/SLR mini gauge to a mounting surface. |
| Proton part number | 00050MC042 |
| Vibration reducing kit | |
|  | <ul style="list-style-type: none"> For use with the above Base Plate (00050MC042) in high-vibration environments. |
| Proton part number | 00050MC043 |
| 3D Adjuster Plate | |
|  | <ul style="list-style-type: none"> For use with the above Base Plate (00050MC042) for precision alignment of the SL/SLR mini gauge to the measured object. Provides $\pm 3^\circ$ of roll and yaw adjustment. |
| Proton part number | 00050MC044 |
| Laser Protection Tube for SL/SLR mini 1220 | |
|  | <ul style="list-style-type: none"> Enclosure of the laser beam to within 10mm of the object for laser safety and harsh environments. |
| Proton part number | 00050MC033 |

Laser Protection Tube for SL/SLR mini 3060

- Enclosure of the laser beam to within 10mm of the object for laser safety and harsh environments.

Proton part number

00050MC037

PROTECTION**Air wipe**

- High-efficiency, air-wiped protection window for dusty/steamy environments with a quick-change window release mechanism.
- Provides an 8 mm push fit tube fitting to connection to a clean air source.

Proton part number

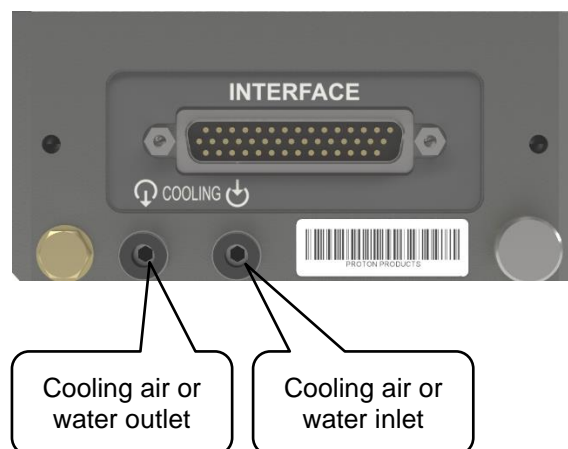
00050MC034

Air quality must meet or exceed ISO 8573.1:2001 Class 1.3.1 (solids.water.oil):

| Specification | Maximum | Units | Class |
|--|---------|--------------------------|-------|
| 0.1 - 0.5 μm solid particle count | 100 | / m^3 | 1 |
| 0.5 - 1 μm solid particle count | 1 | / m^3 | |
| 1 - 5 μm solid particle count | 0 | / m^3 | |
| Water vapour pressure dew point | -20 | $^{\circ}\text{C}$ | 3 |
| Oil aerosol and vapour | 0.01 | mg / m^3 | 1 |

OPTIONAL COOLING SYSTEM

For hot environments, air or water may be pumped through the base of the gauge for cooling.



Note: cooling is required if the case temperature of the gauge exceeds 50°C.

The case temperature of the gauge can be viewed on the Status page 2 on CDI4.

| Status | 2/2 |
|------------------------|-----------|
| Case temperature [°C]: | 0.0 |
| Gauge core ver: | 0.00 |
| Gauge application ver: | 0.00 |
| Gauge software date: | 0-0-0 |
| Gauge Serial Number: | 0 |
| Gauge Gauge Model: | SLmini0 |
| CDI4 software ver: | 5.00 |
| CDI4 software date: | 2022-4-13 |

Air cooling

- The gauge may be air-cooled using factory air regulated with a reducer valve to a pressure of 1.5 ~2.5 bar fed to the cooling inlet.
- The cooling air travels only in the embedded cooling channel in the base of the gauge; it does not come into contact with the internal workings of the gauge.
- Waste air is vented from the cooling outlet; to reduce its acoustic noise, a silencer (e.g. from Norgren or Martonair) may be fitted downstream of the cooling outlet.

Water cooling

| Cooling water specification | Minimum | Typical | Maximum | Units |
|-----------------------------|---------|---------|---------|-------|
| Water temperature | 5 | | 25 | °C |
| Speed of water flow | | 1.2 | | m/s |
| Water pressure | 0.1 | | 0.5 | M/Pa |
| Water flow rate | | | 15 | L/h |

INSTALLATION

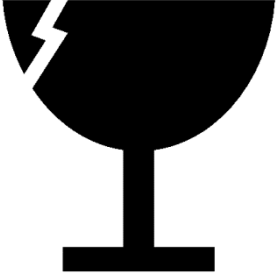


PRECAUTIONS

Operating and storage temperature

| Specification | Minimum | Typical | Maximum | Units |
|-----------------------|---------|---------|---------|-------|
| Operating temperature | +5 | | +40 | °C |
| Storage temperature | 0 | | +45 | °C |

- Do not store or operate the gauge in temperatures outside of the specified ranges.
- Do not install the gauge near high temperature surfaces or objects which may cause it to overheat.
- Storage or operation of the gauge outside the specified temperature range may result in degraded measurement accuracy, malfunction or damage to the gauge.
- All gauges are fitted with internal temperature sensors which will permanently log any over-temperature condition that invalidates the warranty.

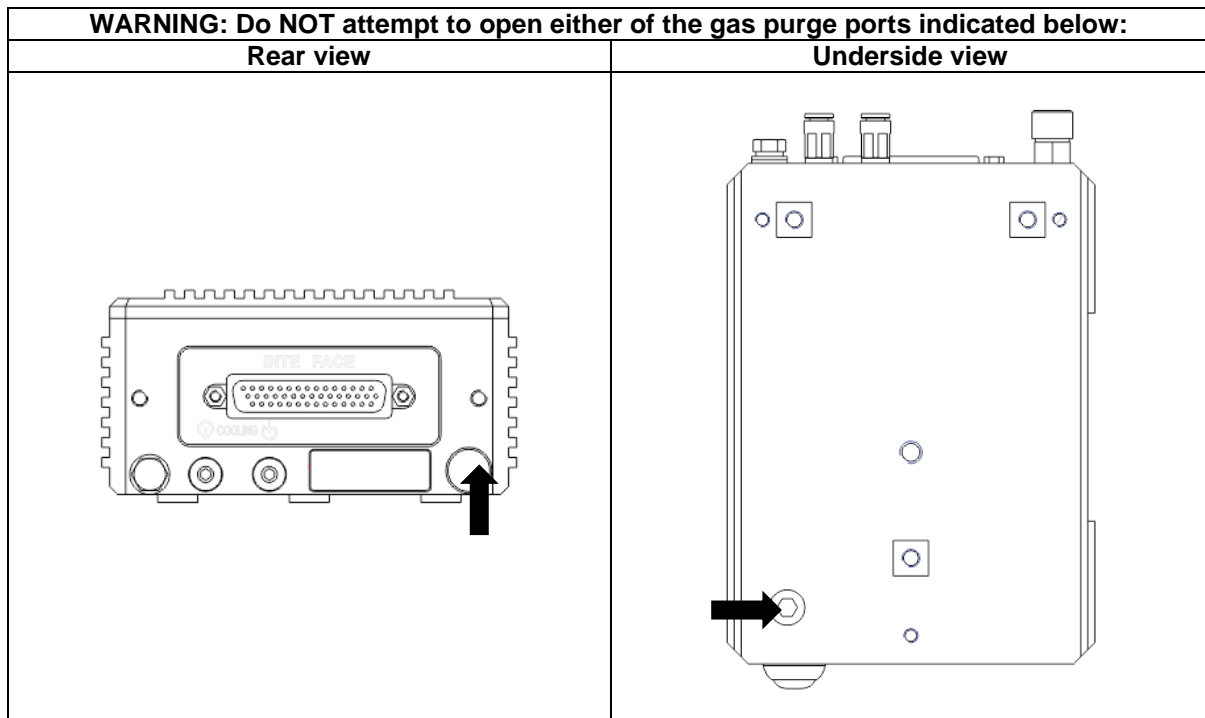
Protect from impact

| | | |
|--|--|--|
|  |  |  |
| Fragile | Do not drop | Protect from impact and mechanical shock |

- The gauge contains delicate optical and electronic assemblies and must never be dropped or struck by other objects.
- Only install the gauge on its mounting/stand when all machining, assembly and transportation of the mounting/stand has been completed.
- Do NOT strike, move or perform machining operations on the mounting/stand with the gauge installed.
- Damage incurred by the gauge as a result of impact, mechanical shock or rough handling is NOT covered by the manufacturer's warranty.

Do not open or disassemble

- The gauge contains no user serviceable components.
- Loosening the gauge screws or removing its cover will invalidate the gauge warranty.
- Damage to or removal of any of the anti-tamper stickers will invalidate the gauge warranty.
- The gauge is factory-purged with dry nitrogen gas to prevent condensation on the internal optics; opening of the gas purge ports (indicated below) will invalidate the gauge warranty.




Periodic maintenance

- The physical condition of the gauge, optional accessories and connecting cables should be checked periodically; if any damage is suspected, then the unit should be taken out of service for inspection and repair or replacement of damaged parts.

Laser radiation hazard

- This product emits class 3B laser radiation; do not view the laser beams emitted by the gauge either directly or by specular reflection.
- For all class 3B laser devices, the safety measures below **MUST** be provided. Some measures are the responsibility of the device manufacturer (Proton Products), whilst other measures are the responsibility of the end-user.
- For further information on laser safety, please refer to European standard BS EN 60825-1:2007 "Safety of laser products; Part 1: Equipment classification, requirements and user's guide".

| Safety Measure | Description | Provided by |
|-------------------------|--|-------------|
| Laser Safety Officer | A Laser Safety Officer (LSO) must be appointed by the end-user organisation and is responsible for ensuring that both the equipment and staff comply with laser safety regulations. | End-user |
| Laser safety training | The end-user organisation must provide appropriate laser safety training for all operators and maintenance personnel working in close proximity to the gauge. | End-user |
| Laser enable key-switch | A key-switch to disable the laser diode should be wired to the LSR_EN input. The laser safety officer should be responsible for the key and must withhold it during system maintenance or if the system fails to comply with laser safety regulations. | End-user |
| | A laser enable key-switch is provided on the optional PSU-BOB-mini. | Proton |

| Safety Measure | Description | Provided by |
|--|--|--------------------|
| Contain and terminate beam path | <p>Terminate the laser beams at the end of their useful length (behind the measured object) with a beam block.</p> <p>Contain laser beam paths with laser guards which have closure switches wired to the SHUT_EN input so that the laser shutter is closed if any guard is opened.</p> <p>Do NOT permit the laser beams to be directed into open space.</p> | End-user |
| Prevent specular (mirror-like) reflections | <p>Never direct the laser beams at specular (mirror-like) reflectors.</p> <p>Remove all reflective objects such as jewellery or wristwatches before working near the laser beams.</p> | End-user |
| Emission indicator | <p>Illumination of the "LASER" LED on the gauge indicates laser emission.</p> <p>An external laser emission warning light may be triggered by the SHUT_ST output.</p> | Proton End-user |
| Laser shutter switch | <p>The switch to the side of the laser window opens or closes the laser shutter which blocks laser emission.</p> <p>If the gauge is to be mounted in an inaccessible location, then this switch should be set to the open position and a remote, external laser shutter switch wired to the SHUT_EN input.</p> | Proton End-user |
| Laser protection eyewear | Laser protection eyewear rated with the Optical Density (OD) rated for Class 3B lasers must be worn whenever there is a risk of eye exposure to the laser, for example during gauge alignment (see the "Laser Safety Parameters" section for information on laser wavelength, power and power densities). | End-user |
| Laser warning signs | <p>Class 3B laser warning signs must be displayed in the working area; precautions on the warning signs must be followed.</p> <p>Example class 3B laser warning signage:</p>  | End-user |

Optical windows

- Do not allow smoke, water, steam, dust or other debris to come into contact with any of the optical window.
- Obstruction of the optical window may degrade measurement accuracy or inhibit measurement.
- If the optical window appears to be damaged or misaligned, then the unit should be sent to a Proton Products authorised service agent for repair.
- If the optical window requires cleaning, then refer to the cleaning procedure detailed below to minimise the risk of scratching the windows.

Optical window cleaning procedure

- The optical window is manufactured from anti-reflection coated optical glass; it must be treated with the same level of care as a high-performance camera lens.
- **Before inspecting or cleaning the optical window, ensure that the gauge is powered off, the LSR_EN key-switch is locked out and no laser light is emitted.**

| Required items | Notes |
|--|---|
| Small blower brush | Such as the type used to remove dust from camera lenses. |
| Lens cleaning tissues or micro-fibre lens cleaning cloth | Do NOT use facial tissues as these can scratch delicate optics. |
| Lens cleaning solution | Such as the type specified for cleaning camera lenses. |

1. Use the small blower brush to remove any visible dust on the optical window.
2. Apply a few drops of lens cleaning solution to a fresh lens cleaning tissue or a clean micro-fibre lens cleaning cloth.
3. Gently wipe the optical window from the centre outwards; apply only light pressure to the tissue or cloth when wiping the optical window.
4. Repeat as necessary with fresh tissues or a clean section of cloth until the optical window is clean and free of all smears and smudges.

INSTALLATION SEQUENCE

Unpack the gauge and check for missing accessories and shipping damage.

Mechanical installation:

1. Mount the gauge securely either on a user supplied mount or on an optional Proton Products mounting plate.

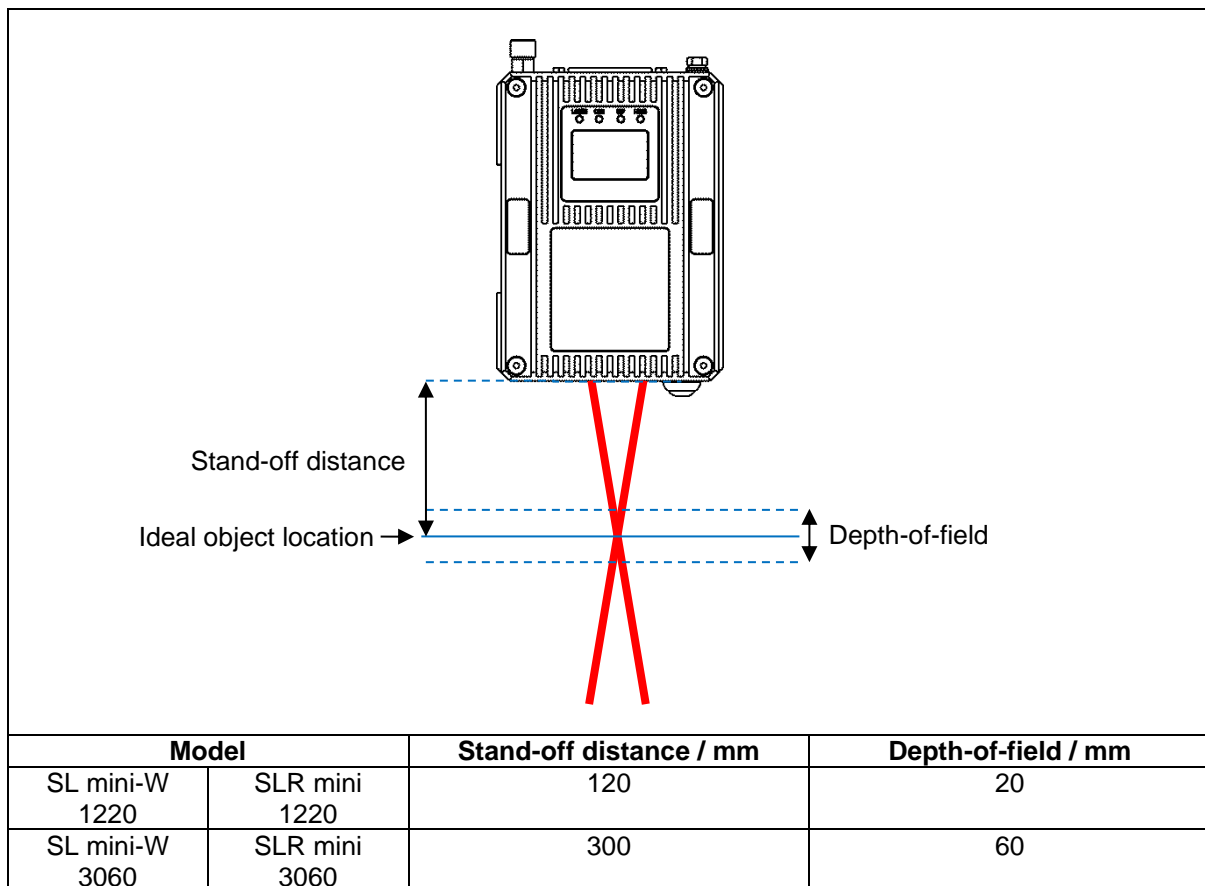
Electrical installation:

1. Install earth connections.
2. Connect the gauge to an optional Proton Products PSU-BOB power supply and break-out box.
3. Install laser safety connections (laser enable, shutter enable and shutter status).
4. Install communications interface connections (RS-232, Ethernet or optional PROFIBUS, PROFINET or EtherNet/IP).
5. Install electrical interface connections (logic inputs, logic outputs, pulse outputs) using the optional Proton Products PSU-BOB breakout box or terminal strip.
6. Connect a PC installed with the PCiS_SLmini software to the gauge via the RS-232, Ethernet or optional PROFINET or EtherNet/IP communications interface.
7. Configure the gauge using the PCiS_SLmini software.

MECHANICAL INSTALLATION

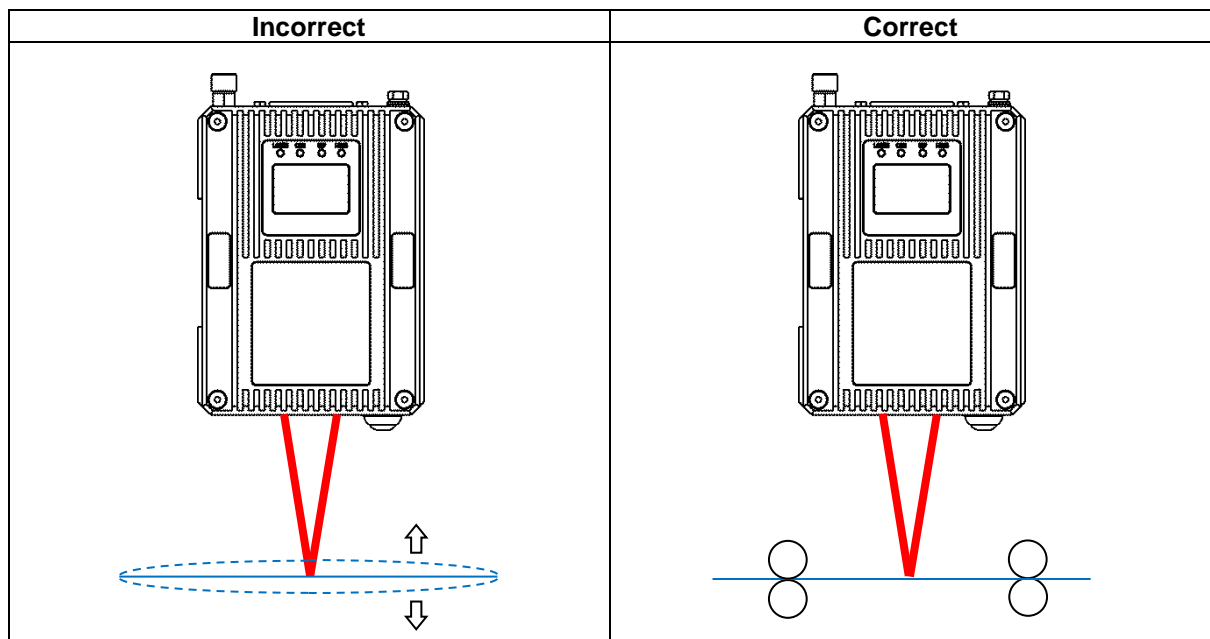
Stand-off distance and depth-of-field

- For best accuracy, locate the measured object at the specified stand-off distance to the gauge.
- Speed and length measurement is possible for objects located away from the specified stand-off distance but still within the depth-of-field; however the measurement accuracy may be degraded by the reduced signal strength.



Object stabilisation

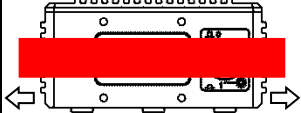
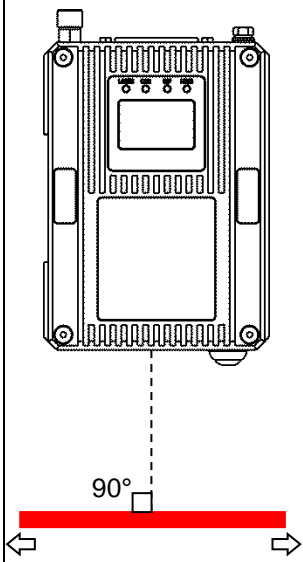
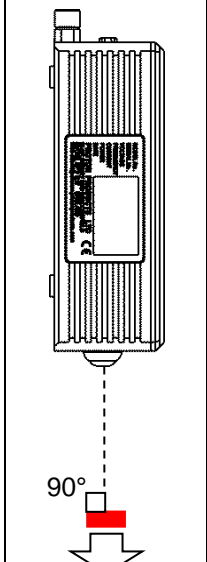
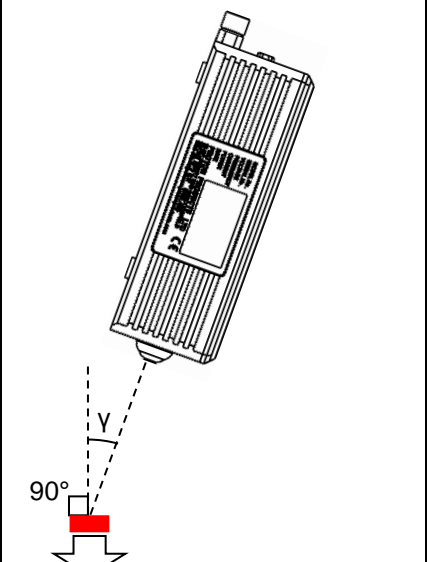
For accurate speed and length measurements, the distance between the measured object and the gauge must be kept constant; the measured object must be guided to prevent flutter:

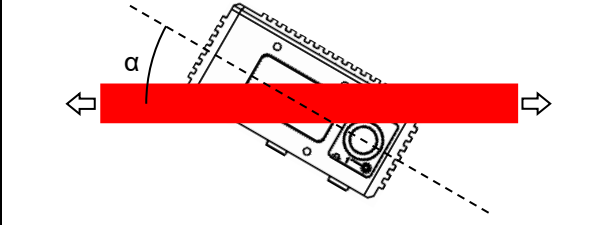
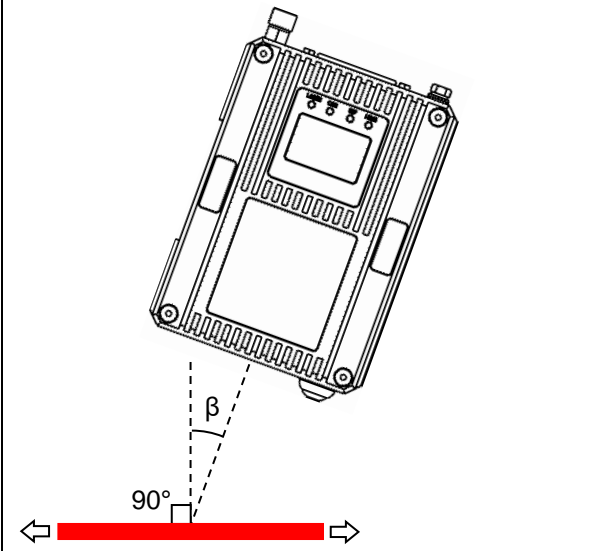


The end-user must provide suitable mechanisms for guiding and stabilising the motion of the measured object.

Optical alignment

Non-perpendicular alignment of the speed and length gauge to the measured object will degrade measurement accuracy; it is recommended the gauge is installed and aligned by technicians with metrology experience who understand the implications of even a small angular misalignment.

| Correct Gauge Alignment | | | |
|---|--|---|---|
| Roll alignment | Yaw alignment | Pitch alignment | |
| | | Ideal | Acceptable for γ within $\pm 5^\circ$ ($\gamma \neq 0$ may be used to prevent receiver saturation for highly-reflective objects) |
|  |  |  |  |

| Incorrect Gauge Alignment | |
|---|--|
| Roll cosine error | Yaw cosine error |
|  |  |

| Compounded roll and yaw cosine error | | |
|--|--------------------|-----------------------|
| Measured speed = (True object speed) × cos (α) × cos (β) | | |
| Error angle α or β / degrees | cos (α) or cos (β) | Measurement error / % |
| 0 | 1.000000 | 0.000 |
| 0.25 | 0.999990 | -0.001 |
| 0.50 | 0.999962 | -0.004 |
| 0.75 | 0.999914 | -0.009 |
| 1.0 | 0.999848 | -0.015 |
| 2.0 | 0.999391 | -0.061 |
| 3.0 | 0.998630 | -0.137 |
| 4.0 | 0.997564 | -0.244 |
| 5.0 | 0.996195 | -0.381 |
| 10 | 0.984808 | -1.519 |

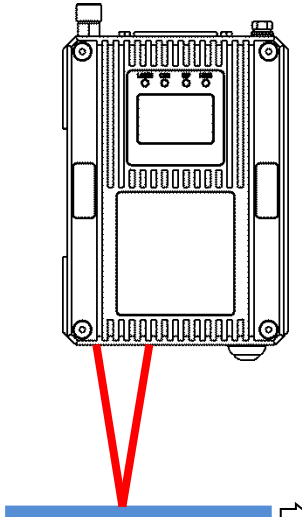
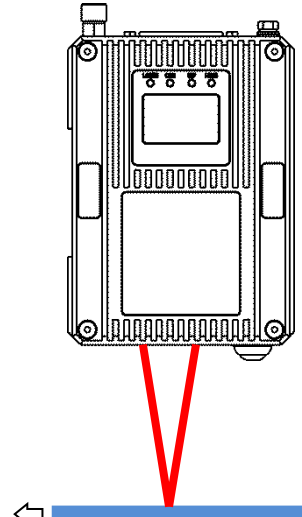
Measurement Direction

SL mini-W Unidirectional Speed and Length Gauge

The unidirectional SL mini-W speed and length gauge interprets motion in either direction as a positive speed and an increase in length, thus correct length accumulation requires that the object must only move in one direction (reverse motion will incorrectly cause the length to increment, not decrement).

Length measurements during line stoppage may exhibit a positive error due to microscopic vibration of the object; hence it is recommended that the “Length hold” function on the SL mini-W logic input is activated by the line controller when the line is stationary to temporarily suspend speed measurement and length accumulation.

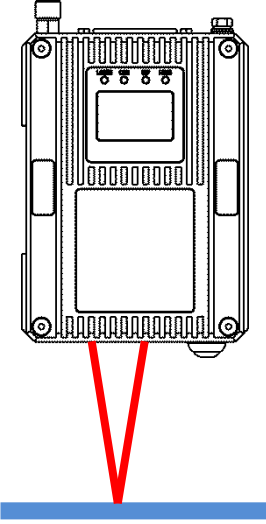
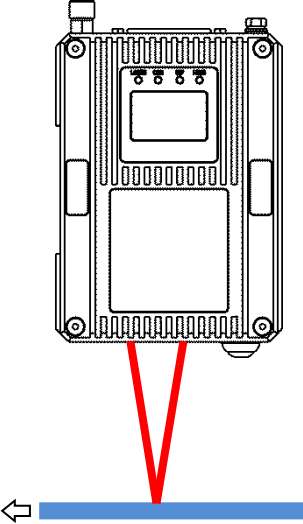
For production lines that require correct length accumulation during direction reversals or line stoppage (without using the “Length hold” function), it is recommended that the SLR mini-W is used.

| SL mini-W | | Left to right | | Right to left | |
|-------------------------|---------------------------|--|--------------|--|--------------|
| Object motion direction | |  | |  | |
| | | | | | |
| Count | Rev Direction logic input | Speed | Length | Speed | Length |
| [Up] | Inactive | Positive | Incrementing | Positive | Incrementing |
| Down | Active | Negative | Decrementing | Negative | Decrementing |

[] factory-default setting

SLR mini-W Bidirectional Speed and Length Gauge

The bidirectional SLR mini-W speed and length may be used for production lines that exhibit bidirectional motion and line stoppage.

| SLR mini-W | | | Left to right | | Right to left | |
|-------------------------|---------------|---------------------------|---|--------------|---|--------------|
| Object motion direction | | |  | |  | |
| | | | | | | |
| Count | Input DW12.12 | Rev Direction logic input | Speed | Length | Speed | Length |
| [Up] | [0] | Inactive | Negative | Decrementing | Positive | Incrementing |
| Down | 1 | Active | Positive | Incrementing | Negative | Decrementing |

[] factory-default setting

Mechanical mounting

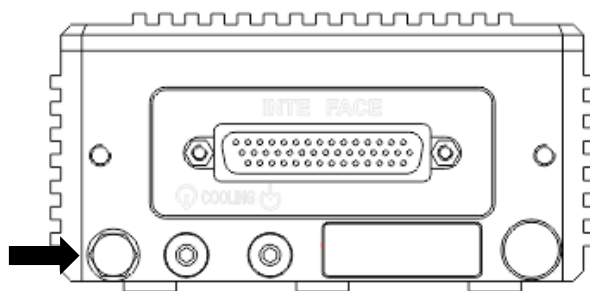
It is preferable for the gauge to be mounted in isolation from the machine or production line using a precision base plate fitted to a mounting arm (if this is not possible then the gauge must be mounted on rubber vibration isolation mounts). The mounting arm should be kept as short as possible to avoid vibration or twisting.

- Please see the dimensional drawings for mounting hole locations.
- Three M5 tapped holes are provided in the base of the gauge; select appropriate length screws which do not bottom out in these holes.

| Specification | Minimum | Typical | Maximum | Unit |
|---|---------|---------|---------|------|
| Mounting surface flatness (machined flat and even) | | | 0.15 | mm |
| M5 mounting hole depth (do not allow bolts to bottom out) | | | 6 | mm |
| M5 mounting bolt torque | | | 6 | Nm |

ELECTRICAL INSTALLATION

Earth connection



Connector type: M5 bolt

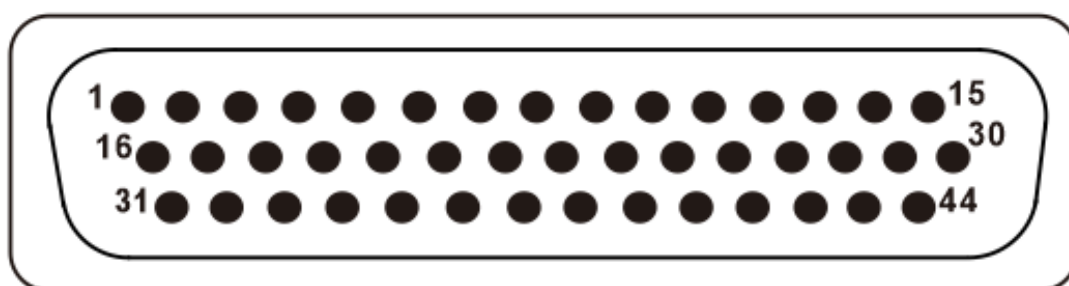
- An earth wire of at least 6mm² must be attached via a crimp on ring terminal to the dedicated M5 earth bolt on the case of the gauge.
- Do not rely on the mounting bolts to provide a reliable earth path.
- If a height stand is used then it must also be earthed via its own dedicated earth wire.
- All earth wires should be kept as short as possible.

Shielded Cables

- Use shielded cable for all signal connections.
- Ensure that all cable shields are correctly clamped and electrically connected to their connectors and metal connector shells at both ends.
- Ensure that the shields of cables connecting to the end user's equipment are clamped to earth at their destination.

LASER ENABLE

- The laser enable input is provided for compliance with laser safety regulations.
- The laser diode in the gauge may be energised only if the “LSR_EN” pin (pin 29) is connected (via an external user-supplied switch contact) to any one of the “DGND” pins (pins 3, 4, 15, 28, 34, 44).
- The gauge requires a few minutes for the laser temperature to stabilise and for valid measurement after “LSR_EN” is connected to “DGND”. For this reason, it is recommended that the laser enable input is connected to a safety interlock that is active infrequently, such as a maintenance lock-out key switch.
- Safety interlocks that are frequently activated and require the gauge to immediately resume measurement upon deactivation (such as a machine guard door) should be connected to the shutter enable input (“SHUT_EN”) described in the next section.

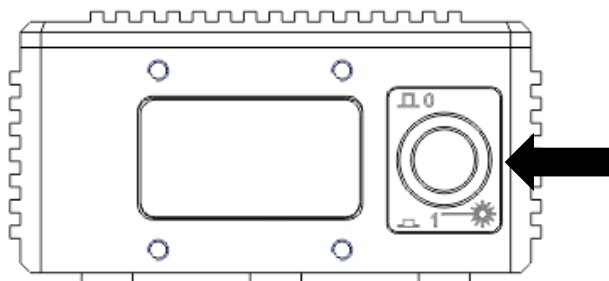


Connector type: DB44 male (socket)

| Connector type: DB44 male (socket) | | | | | |
|------------------------------------|-----|-------------|-------------------------------------|-----------------------------------|-------------------|
| Functional group | Pin | Designation | Description | Notes | |
| Shield | S | Shield | Shield | Connect to cable and plug shields | |
| Power supply and signal ground | 1 | +24V | +24V power supply | | |
| | 2 | SUPPLY | | | |
| | 3 | DGND | Power supply and signal ground (0V) | | |
| | 4 | | | | |
| | 28 | | | | |
| Laser enable | 29 | LSR_EN | Laser enable | Connection | Laser diode state |
| | | | | Open | Off (no emission) |
| | | | | Connected to DGND | On (emission) |

SHUTTER CONTROL SWITCH, SHUTTER ENABLE INPUT AND SHUTTER STATE OUTPUT

The shutter control switch (located on the front of the gauge), the shutter enable input (SHUT_EN) and shutter status output (SHUT_ST) are provided for compliance with laser safety regulations.

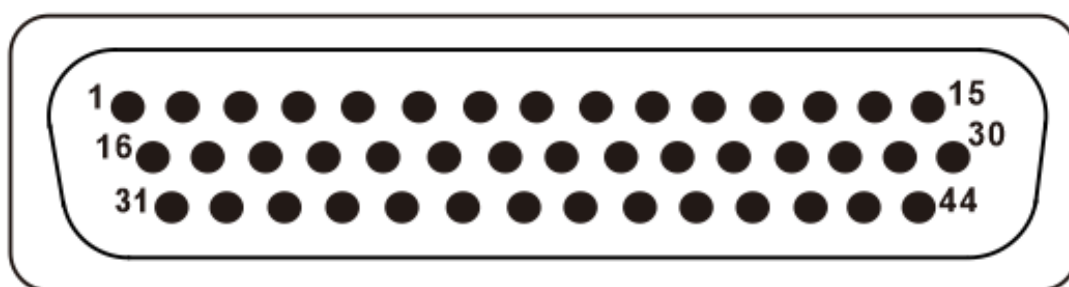


The SHUT_EN input and the shutter control switch operate in conjunction as follows:

| SHUT_EN input | Shutter control switch position | Shutter state | Laser output |
|-----------------|---------------------------------|---------------|--------------|
| Open | O | Closed | Blocked |
| Open | I | Closed | Blocked |
| Shorted to DGND | O | Closed | Blocked |
| Shorted to DGND | I | Open | Emitting |

- The shutter control switch and SHUT_EN input blocks laser beam emission without switching off the laser diode, thus no warm up time is required when the shutter is opened and the gauge may be used immediately for measurements.
- The SHUT_EN input is intended for connection to a safety interlock switch that may be frequently opened, such as on a machine guard or laser safety shield.
- The SHUT_ST output is electrically independent of the SHUT_EN input; the SHUT_ST signal is taken directly from an optical sensor in the path of the shutter, thus it indicates the shutter state even in the event of shutter actuator failure.

SHUT_EN input electrical specifications



Connector type: DB44 male (socket)

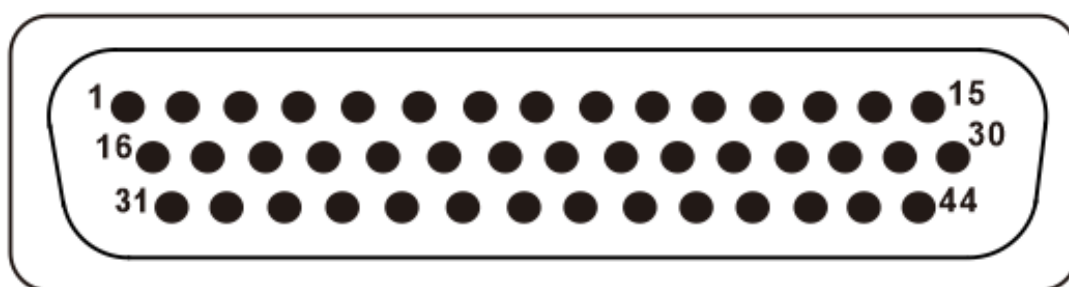
Connector type: DB44 male (socket)

| Functional group | Pin | Designation | Description | Notes | | |
|--------------------------------|-----|-------------|-------------------------------------|---|---------|----------|
| Shield | S | Shield | Shield | Connect to cable and connector shields | | |
| Power supply and signal ground | 1 | +24V SUPPLY | +24V power supply | | | |
| | 2 | | | | | |
| | 3 | DGND | Power supply and signal ground (0V) | | | |
| | 4 | | | | | |
| | 44 | | | | | |
| Shutter control | 30 | SHUT_EN | Shutter control input | Connection | Shutter | Laser |
| | | | | Low state (logic 0) / connected to DGND | Open | Emitting |
| | | | | High state (logic 1) / unconnected | Closed | Blocked |

- The SHUT_EN input is NOT isolated from earth.
- The input is internally pulled up to +15V via an 8.2kΩ resistor and will default to the high state if left unconnected.
- The input will source a minimum current of 3mA when externally pulled down to the low state.

| Specification | Minimum | Typical | Maximum | Units |
|------------------------------------|---------|---------|---------|-------|
| Low state (logic 0) input voltage | | | 3 | V |
| High state (logic 1) input voltage | 10.5 | | | V |
| Absolute input voltage | -30 | | 30 | V |
| Low state source current | 3 | | | mA |

SHUT_ST output electrical specifications



Connector type: DB44 male (socket)

Connector type: DB44 male (socket)

| Functional group | Pin | Designation | Description | Notes | | |
|-------------------------|-----|-------------|-------------------------------------|--|---------|----------|
| Shield | S | Shield | Shield | Connect to cable and connector shields | | |
| Power supply and ground | 1 | +24V SUPPLY | +24V power supply | | | |
| | 2 | | | | | |
| | 3 | DGND | Power supply and signal ground (0V) | | | |
| | 4 | | | | | |
| | 28 | | | | | |
| Shutter control | 27 | SHUT_ST | Shutter status output | Signal | Shutter | Laser |
| | | | | Pulled down to DGND | Closed | Blocked |
| | | | | Floating | Open | Emitting |

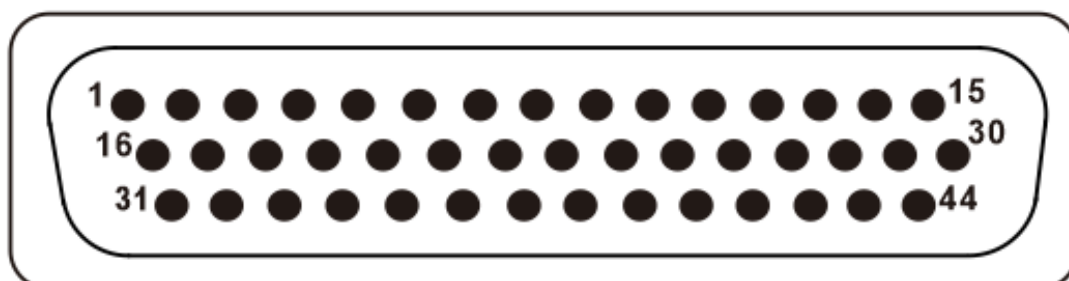
- The SHUT_ST output is NOT isolated from earth.
- The SHUT_ST output must NOT be used to directly drive high-current or inductive loads.
- It is recommended that the SHUT_ST output is used to drive an opto-isolated solid-state relay.

| Specification | Minimum | Typical | Maximum | Units |
|------------------------------|---------|---------|---------|-------|
| Logic output to DGND voltage | | | +25 | VDC |
| Current | | | 0.1 | A |

POWER SUPPLY

| Specification | Minimum | Typical | Maximum | Units |
|-----------------------|---------|---------|---------|-------|
| Power supply voltage* | 18 | 24 | 30 | VDC |
| Power consumption | | | 15 | W |

**If a long power supply cable with a significant voltage drop is used, then ensure that the voltage at the gauge connector does not fall below the minimum value.*



Connector type: DB44 male (socket)

| Functional group | Pin | Designation | Description | Notes |
|------------------|-----|-------------|--------------------------|-------|
| Shield | S | Shield | Shield | |
| Power supply | 1 | +24V | +24V power supply | |
| | 2 | SUPPLY | | |
| | 3 | DGND | Power supply ground (0V) | |
| | 4 | | | |

Powering on the gauge

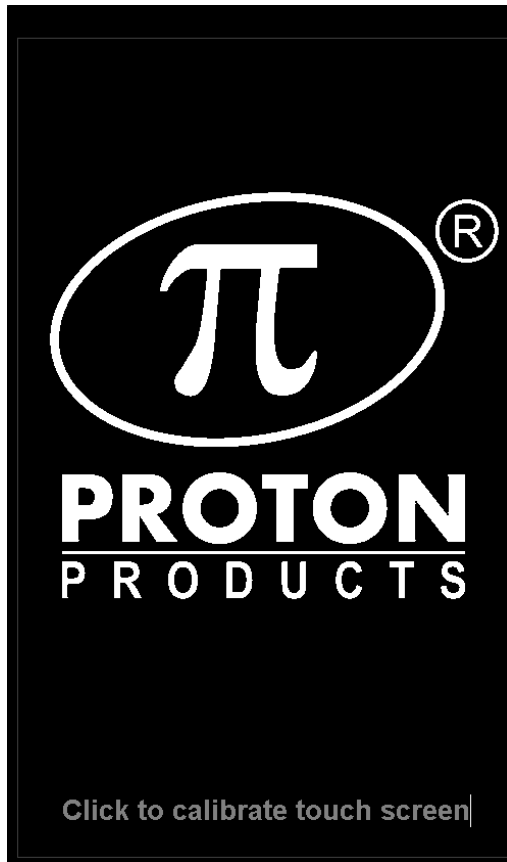
The gauge has no power switch; as soon as power is applied it will power up and perform some self-tests. Measurement will begin after a warm-up period of a few minutes required for the temperature of internal components to stabilise.

Powering off the gauge

The gauge has no power switch; it may be powered off by switching off or disconnecting the power supply to the unit.

CONFIGURATION VIA CDI4

POWER ON SCREEN



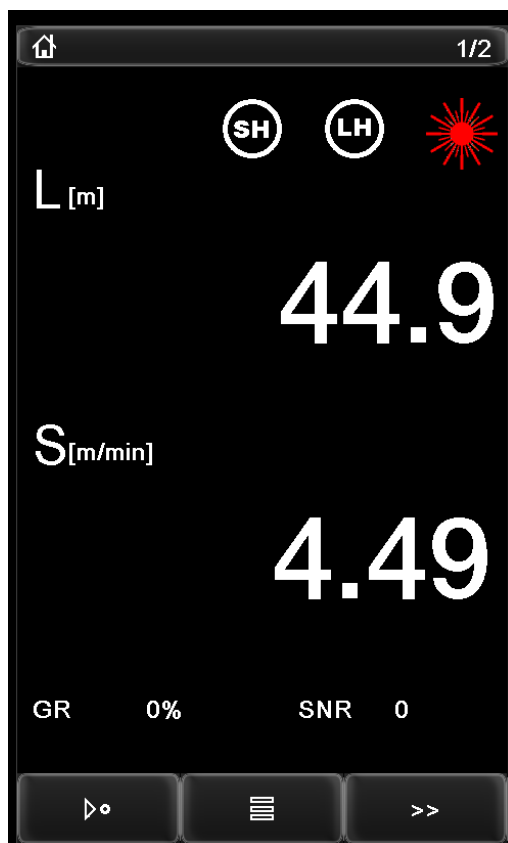
When the gauge is powered on, the Proton welcome screen will be displayed momentarily.

Touch screen calibration

If the CDI4 touch screen can be calibrated using the following procedure:

1. Press the "Click to calibrate touch screen" message during gauge power on to access the screen calibration function.
2. Tap the screen as directed, the screen will be calibrated.

HOME PAGE 1 (NORMAL MODE)



Home page 1 (in normal mode) displays:

Speed hold / Length hold / Laser status

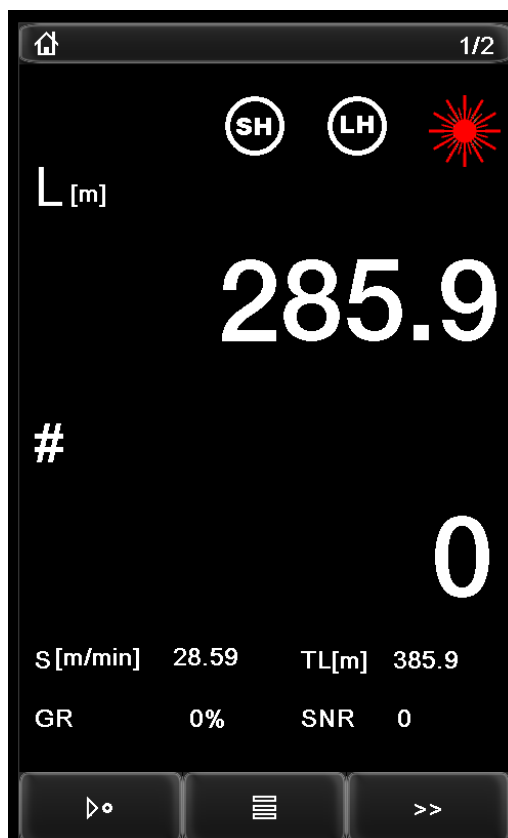
- Current measured total length

- Current measured speed

- GR: Good readings level

- SNR: Signal-to-Noise Ratio

HOME PAGE 1 (BATCH MODE)



Home page 2 (in batch mode) displays:

Speed hold / Length hold / Laser status

- Current measured batch length


- Current batch number

- Current measured speed

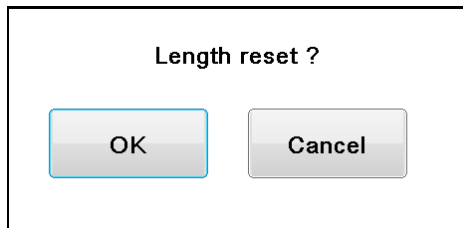
- Current measured total length

- GR: Good readings level


- SNR: Signal-to-Noise Ratio


Press the  button to reset the current measured length to zero.

A pop-up window will appear after pressing this button:



Press the "OK" button to reset the length to zero, or press the "Cancel" button to cancel the operation.

Press the  button to access the function menu page.

Press the  button to advance to the next page.



Speed hold: the symbol will appear on the home page 1 when the logic input is set to Speed Hold.



Length hold: the symbol will appear on the home page 1 when the logic input is set to Length Hold.



Laser status: the symbol will appear on the home page 1 when the gauge laser diode is power on. When the diode is power off, the symbol will flash.


HOME PAGE 2 (NORMAL AND BATCH MODE)



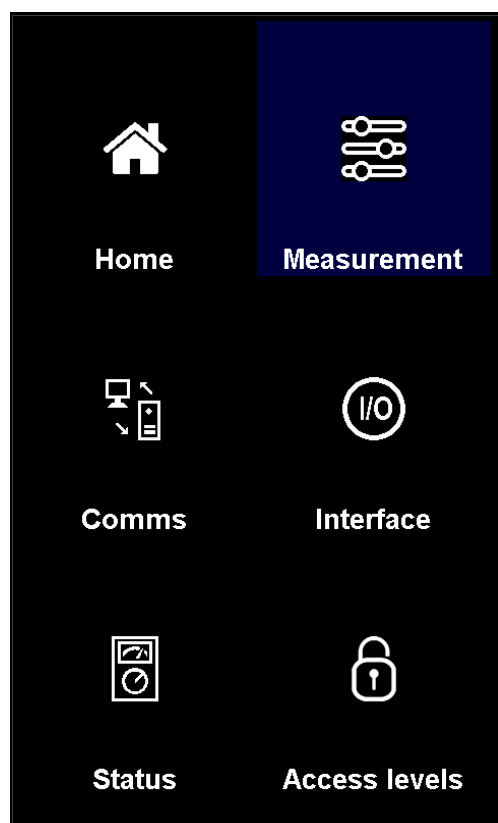
Home page 2 displays:


- The proportion of which has currently been measured relative to the value of preset length 1, up to 100%.
- The value of Preset Length 1
Adjust Preset Length 1 by clicking on the value, entering the new value and clicking the "OK" button.
- The proportion of which has currently been measured relative to the value of preset length 2, up to 100%.
- The value of Preset Length 2
Adjust Preset Length 2 by clicking on the value, entering the new value and clicking the "OK" button.
- Set the required x-Box height ranging from 0~200mm (only if the x-Box is installed and enabled).
- Current x-Box height display.

Press the  button to access the function menu page.

Press the  button to return to "Home Page 1".

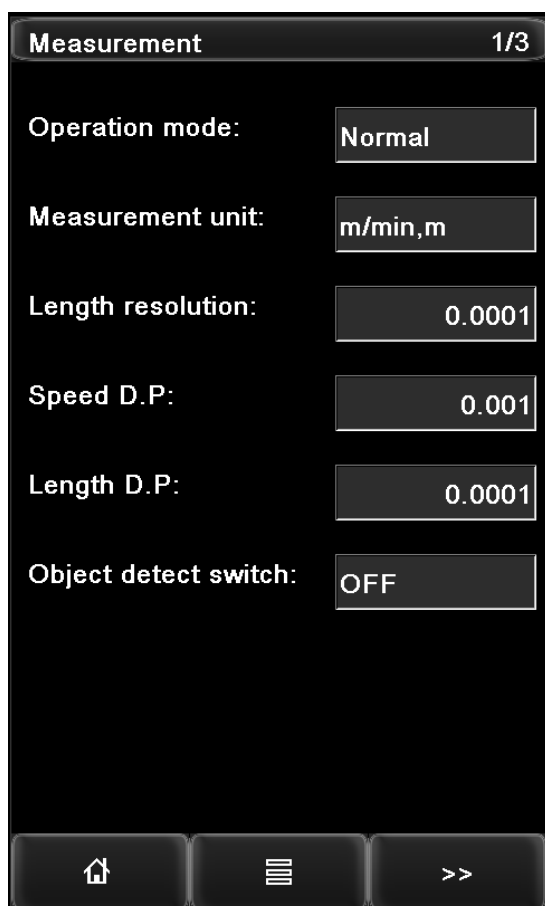
FUNCTION MENUS



Press the  button on the home page to access this page.

Press the **Home** icon to return to the home page; or press the other icons to access the parameter configuration pages.

MEASUREMENT



Press the **Measurement** icon on the home page to access the Measurement page 1.

- Select the operation mode from options: Normal; Batch


- Select the measurement unit from options: m/min, m; ft/min, ft; ft/min, yds; ft/min, inch; yds/min, yds.


- Select the length resolution from options: 0.1&0.0001;


- Select the speed decimal place.

- Select the length decimal place.

- Select the object detect switch from options: OFF; ON.

Press the  button to return to the home page.

Press the  button to access the function menu page.

Press the  button to advance to the next page.

Operation Mode: Normal / Batch mode

In Normal mode, the SL gauge is used to measure one continuous product.

In Batch mode, the SL gauge is used to measure many items of similar length in a batch of a particular amount. For example, it may be a batch of 4000x 3-metre lengths of cable, with the SL gauge emitting a pulse output every 3 metres to an inkjet printer.

Measurement Unit: m/min,m; ft/min,ft; ft/min,yds; ft/min,inch; yds/min,yds

If the measurement unit is changed (for example from metres to feet or yards), the pulse and analogue outputs will be changed accordingly.

Length resolution: 0.1; 0.0001

This affects the actual length and speed readings, and the readings sent to an CDI4 display, or via any of the communications options.

Speed D.P: 1; 0.1; 0.01; 0.001

Adjust the decimal place of the speed reading.




Length D.P: 0.1; 0.01; 0.001; 0.0001

Adjust the decimal place of the length reading.

Object detect switch: OFF / ON

If "ON" is selected, then the measured length is reset to zero on detection of a new object.

If "OFF" is selected, then the measured length continues to accumulate from the previous value on detection of a new object.

| Measurement | | 2/3 |
|---|--------|-----|
| Auto reset when O.D.: | OFF | |
| Length auto save: | OFF | |
| Speed average time[ms]: | 0 | |
| Hold time [ms]: | 0 | |
| Length offset [m]: | 0.0000 | |
| Speed compensation: | 0.0000 | |
| Min speed limit [m/min]: | 0.00 | |
| Acc limit [m/min/s]: | 0 | |
|    | | |

- Select auto reset switch from options: OFF; ON.

- Select the length auto save switch from options: OFF; ON.

- Set the value of speed average time.


- Set the value of hold time.


- Set the value of length offset.


- Set the value of speed compensation.

- Set the value of minimum speed limit.

- Set the value of acceleration limit: 1~9999

Press the  button to return to the home page.

Press the  button to access the function menu page.

Press the  button to advance to the next page.

Auto reset when O.D: OFF / ON

If "ON" is selected, then the measured length is reset to zero on detection of a new object.

If "OFF" is selected, then the measured length continues to accumulate from the previous value on detection of a new object.

Length auto save: OFF / ON

If "ON" is selected, when the gauge is powered off, the current length will be stored in memory, and length count will continue from that point on subsequent power-on.

If "OFF" is selected, when the gauge is powered off, the current length will NOT be stored in memory, and length count will begin from 0 (zero) on subsequent power-on.

Speed average time: 0~5000ms

If set to 0 (zero), the speed reading is not averaged. If set to a value from 1~4999 ms, the average speed is calculated at that interval.

The speed averaging time affects the pulse output as well as the analogue output, although the outputs can be based on the immediate speed (non-averaged speed) or the averaged speed.

A long speed averaging time means that the pulse output is more stable, but less sensitive to small and sudden changes in measured velocity.

Hold time: 1ms ~ 5000ms

Hold time is the short period of time (typically 2 seconds) for which the current speed is held while the gauge is unable to make a reading. This allows, for example, for momentary movements of the object surface outside the measuring field. A long hold time is a disadvantage when the end of a product passes out of the gauge's measuring field, and measurement length continues to accumulate until the hold time is over.

If a minimum speed limit is set and the speed falls below this limit, the gauge records a speed of 0.

It is possible to set the hold time to 0, but it is not recommended.

Length offset: 0 ~ 3276.7m

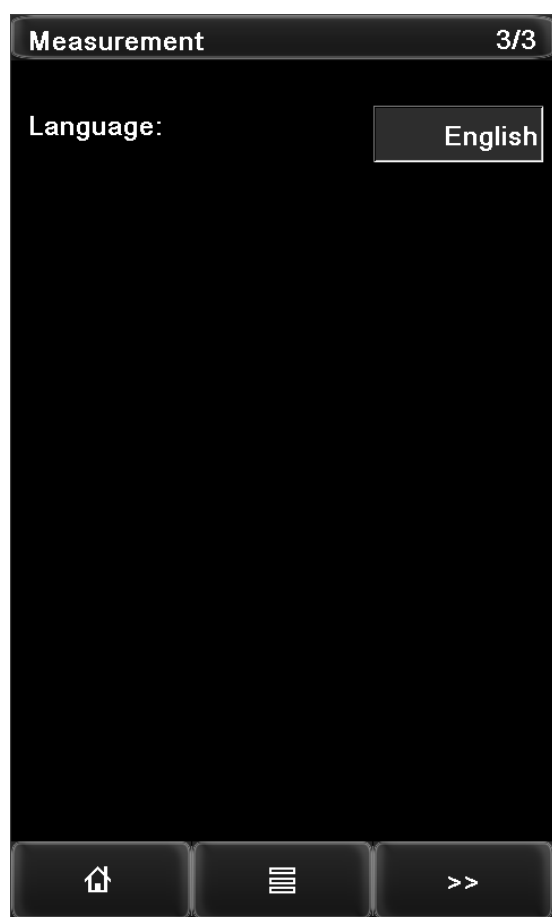
This is used if a product is threaded through a production line before the production line is started, particularly if the gauge is sited at the beginning of the line. A positive length (Length offset) can be added to compensate for the unmeasured length.

Speed Compensation: 0.0001 ~ 6.5535


Set a value other than the default value of 1.0000 to apply a compensation factor to the measured speed (actual speed=measured speed×compensation).

Min speed limit: 0 ~ 6553.5 m/min


If the speed falls below this limit, the gauge will show zero speed and stop accumulating measured length. This feature is useful where the product is not completely stationary when the production line is stopped. Since the gauge can measure very low speeds and does not distinguish between forward and backward movement, the gauge's measured length reading may continue accumulating. However, if a minimum speed is set, this problem is prevented. If the speed falls below the minimum speed limit, the gauge records a speed of 0. To disable this function, set the minimum speed limit to zero.



- Select the CDI4 software language from options: English; Chinese

Press the  button to return to the home page.

Press the  button to access the function menu page.

Press the  button to advance to the next page.

COMMUNICATIONS

Comms 1/4

RS232 baudrate:

RS232 protocol:




RS422/485 baudrate:

RS422/485 protocol:

CAN Baudrate:

Gauge CAN address:

CDI4 CAN address:

- Select RS232 baud rate from options: 4800; 9600; 19200; 38400; 115200.

- Select RS232 protocol from options: Modbus; PROTON; ZM400 Printer.


- Select RS422/485 baud rate from options: 4800; 9600; 19200; 38400; 115200.


- Select RS422/485 protocol from options: Modbus; PROTON; ZM400 Printer.


- Select CAN baud rate from options: 250K; 500K; 1000K.

- Set the gauge CAN address.

- Set the CDI4 CAN address.

Press the  button to return to the home page.

Press the  button to access the function menu page.

Press the  button to advance to the next page.

Comms-Ethernet 2/4

Modbus ID:




DHCP:

IP Addr:

Subnet:

Gateway:

MAC Addr: 00-00-00-00-00-00

- Enter the Modbus ID of the gauge.


- Enable or disable the DHCP function.


- Set the IP address of the gauge head then click the "OK" button to confirm


- Set the Subnet Mask of the network then click the "OK" button to confirm.

- Set the Gateway IP address of the network then click the "OK" button to confirm.

- The MAC address of the gauge.

Press the  button to return to the home page.

Press the  button to access the function menu page.

Press the  button to advance to the next page.

Comms-iBUS 3/4

iBUS




iBUS type: NONE

iBUS type:




DEV ID:

DEV Baudrate:

Profibus ID:

- Select the industrial communication bus type.
Note that if the iBUS type is changed, the gauge must be reboot to take effect.
- Set the device ID of the gauge.
- Select the DeviceNet baud rate from options: 125K; 250K; 500K.
- Set the Profibus ID of the gauge then click the “OK” button to confirm.

Press the  button to return to the home page.
 Press the  button to access the function menu page.
 Press the  button to advance to the next page.

Comms 4/4

iBUS




DHCP:

IP Addr: . . .




Subnet: . . .

Gateway: . . .

MAC Addr: 00-00-00-00-00-00

- Enable or disable the DHCP function.
- Enter the IP address assigned to the gauge.
- Enter the subnet mask for the network.
- Enter the gateway IP address for the network.

Press the  button to return to the home page.
 Press the  button to access the function menu page.
 Press the  button to advance to the next page.

COMMUNICATIONS

Comms 1/4

RS232 baudrate: 4800

RS232 mode: Modbus

RS422 baudrate: 4800




RS422 mode: Modbus

CAN Baudrate: 250K


Gauge CAN address: 0


CDI4 CAN address: 0


CDI4 CAN terminator: OFF

- Select RS232 baud rate from options: 4800; 9600; 19200; 38400; 115200.
- Select RS232 mode from options: PROTON; Modbus.
- Select RS422 baud rate from options: 4800; 9600; 19200; 38400; 115200.
- Select RS422 mode from options: PROTON; Modbus.
- Select CAN baud rate from options: 250K; 500K; 1000K.
- Set the gauge CAN address.
- Set the CDI4 CAN address.
- Set the CDI4 CAN terminator ON or OFF.

Press the  button to return to the home page.

Press the  button to access the function menu page.

Press the  button to advance to the next page.

Comms / Ethernet 2/4

Modbus ID: 0

DHCP: Disabled

IP address: 0 . 0 . 0 . 0




Subnet mask: 0 . 0 . 0 . 0

Gateway: 0 . 0 . 0 . 0

MAC address F8-95-50-01-00-06

UDP IP: 192.168.0. 0

Interval time of UDP[ms]: 0

- Set the Modbus ID.

- Enable or disable the DHCP function.

- Set the IP address of the gauge head then click the "OK" button to confirm.


- Set the Subnet Mask of the network then click the "OK" button to confirm.


- Set the Gateway IP address of the network then click the "OK" button to confirm.


- The MAC address of the gauge.

- Set the UDP IP address.

- Set the Interval time of UDP.

Press the  button to return to the home page.

Press the  button to access the function menu page.

Press the  button to advance to the next page.

Comms / iBus 3/4

iBUS

iBus type: MODBUS_TCP

iBUS type: NONE

DeviceNet ID: 0




DeviceNet baud rate: 125K

PROFIBUS ID: 0

DHCP: Disabled

Endian mode: Big

Home Menu Advance

- Select the industrial communication bus type.
Note that if the iBUS type is changed, the gauge must be reboot to take effect.
 - Set the device ID of the gauge.
 - Select the DeviceNet baud rate from options: 125K; 250K; 500K.
 - Set the Profibus ID of the gauge then click the "OK" button to confirm.
 - Enable or disable the DHCP function.
 - Set the Endian mode.
- Press the  button to return to the home page.
Press the  button to access the function menu page.
Press the  button to advance to the next page.

Comms / iBus 4/4

iBUS




IP address: 0.0.0.0

Subnet mask: 0.0.0.0

Gateway: 0.0.0.0

MAC address F8-96-50-01-00-01

Home Menu Advance

- Enter the gauge IP address.
 - Enter the subnet mask of the network.
 - Enter the gateway IP address of the network.
- Press the  button to return to the home page.
Press the  button to access the function menu page.
Press the  button to advance to the next page.

INTERFACE

Press the **Interface** icon on the function menu page to access the Interface page 1.

- Switch ON or OFF the pulse reset during length reset.

- Select the pulse 1, 2 output mode.

.


- Select the pulse 3, 4 output mode.


- Set the required pulse rate for pulse output 1.


- Set the required pulse rate for pulse output 2.

- Set the required pulse rate for pulse output 3.

- Set the required pulse rate for pulse output 4.

Press the  button to return to the home page.

Press the  button to access the function menu page.

Press the  button to advance to the next page.

Sync pulse at reset: OFF / ON

Select ON to have pulse outputs reset during a length reset.

Pulse group A: P1 P2; P1=/P2; P1=Quad P2; P1/2=Quad P3/4

Select "P1 P2" mode to configure pulse output 1 and pulse output 2 with separate and independent pulse rates.

Select "P1=/P2" mode to couple together pulse output 1 and pulse output 2 as a differential pair, with pulse rate set under "Pulse 1 rate"

Select "P1=Quad P2" mode to couple together pulse output 1 and pulse output 2 as a quadrature pair, with pulse rate set under "Pulse 1 rate".

Select "P1/2=Quad P3/4" mode to configure "Pulse 1", "Pulse 2" and "Pulse 3", "Pulse 4" as a quadrature pair, with pulse rate set under "Pulse 1 rate".

Pulse group B: as per "Pulse group A" above.

Pulse 1, 2, 3, 4 rate

Set the required pulse rate for "Pulse 1, 2, 3, 4 rate" in pulses/unit, where the unit is the "Measurement" unit" (metres, feet, inch or yards) set on the "Measurement" page.

Note: When the "Pulse A" is set to "P1=Quad P2", the "Pulse 2 rate" field is disabled and the "Pulse 1 rate" sets the rate for the quadrature pulse output across both "Pulse output 1" and "Pulse output 2".

Interface

2/6

Pulse group C:

P5 P6

Pulse 5 rate :

0.000

pulse/m

Pulse 6 rate :

0.000

pulse/m

H-Level width [ms]:

0


>>


- Select the pulse 5, 6 output mode


- Set the required pulse rate for pulse output 5.

- Set the required pulse rate for pulse output 6.

- Set the H-level width of the pulse rates.

Press the  button to return to the home page.

Press the  button to access the function menu page.

Press the  button to advance to the next page.

Pulse group C: as per “Pulse group A” above.


Pulse 5, 6 rate

Set the required pulse rate for “Pulse 5, 6 rate” in pulses/unit, where the unit is the “Measurement” unit” (metres, feet, inch or yards) set on the “Measurement” page.




Note: When the “ Pulse C” is set to “P5=Quad P6”, the “Pulse 6 rate” field is disabled and the “Pulse 5 rate” sets the rate for the quadrature pulse output across both “Pulse output 5” and “Pulse output 6”.

| Interface | | 3/6 |
|---------------------|---------------|---|
| LIN1 function 1: | Rev Direction | - Select the logic input 1 function 1. |
| LIN2 function 1: | Rev Direction | - Select the logic input 2 function 1. |
| LIN3 function 1: | Rev Direction | - Select the logic input 3 function 1. |
| LIN1 FUN1 polarity: | Active Low | - Select the logic input 1 function 1 polarity from options: Active Low; Active High. |
| LIN2 FUN1 polarity: | Active Low | - Select the logic input 2 function 1 polarity from options: Active Low; Active High. |
| LIN3 FUN1 polarity: | Active Low | - Select the logic input 3 function 1 polarity from options: Active Low; Active High. |
| Speed direction: | Up/Normal | - Set the direction of the line speed from options: Up/Normal; Down/Invert. |







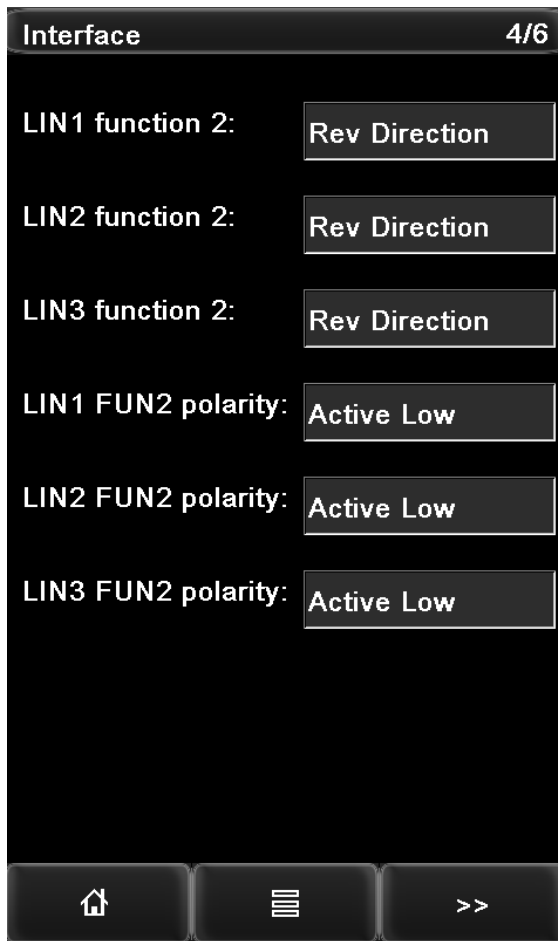
Press the  button to return to the home page.
 Press the  button to access the function menu page.
 Press the  button to advance to the next page.

LIN 1 / 2 / 3 function 1:

Select from the following options:
 Rev Direction;
 Length Hold;
 Display Hold;
 Speed Hold;
 Reset Total Length;
 End of Reel / Batch Length Reset;
 None.

LIN 1 / 2 / 3 FUN1 polarity: Active Low; Active High

Pulling the logic input low (logic 0) or logic input high (logic 1) activates the configured function.



- Select the logic input 1 function 2.

- Select the logic input 2 function 2.


- Select the logic input 3 function 2.


- Select the logic input 1 function 2 polarity from options: Active Low; Active High.


- Select the logic input 2 function 2 polarity from options: Active Low; Active High.

- Select the logic input 3 function 2 polarity from options: Active Low; Active High.

- Set the direction of the line speed from options: Up/Normal; Down/Invert.

Press the  button to return to the home page.

Press the  button to access the function menu page.

Press the  button to advance to the next page.

LIN 1 / 2 / 3 function 2:

Select from the following options:

Rev Direction;

Length Hold;

Display Hold;

Speed Hold;

Reset Total Length;

End of Reel / Batch Length Reset;

None.

LIN 1 / 2 / 3 FUN2 polarity: Active Low; Active High

Pulling the logic input low (logic 0) or logic input high (logic 1) activates the configured function.

Interface

5/6

Laser switch:

OFF

L.O. 1 function:

Gauge OK

L.O. 2 function:

Gauge OK

L.O. 3 function:

Gauge OK

GR threshold [%]

0

Speed response:

Average

Length reset trigg

Level

>>

- Switch the laser ON or OFF.

- Select the logic output 1 function.


- Select the logic output 2 function.


- Select the logic output 3 function.


- Set the Good Readings threshold for logic output.

- Select whether the speed reading used should be averaged. Options: Average; Instant.

- Select the length reset trigger mode: Level; Edge.

Press the  button to return to the home page.

Press the  button to access the function menu page.

Press the  button to advance to the next page.

L.O. 1 / 2 / 3 function

Select the logic output function from the following options:

Gauge OK; Measuring speed;
Preset length 1; Preset length 2;
Good reading; Object Detected;
Gauge Hot

GR threshold: 0~ [60] ~100%

Set the threshold above which the “Good Readings” percentage will trigger pull-down of any logic output configured to the “Good readings” condition.

Speed response: Average; Instant

Select whether the speed reading used should be averaged or not.

Interface

6/6

AOP source:

Speed

AOP full scale [m/min]:

0

AOP Gain:

0

AOP Zero:

0


>>


- Select the analogue output source: Speed; Good reading.


- Set the analogue output full scale value.

- Set the analogue output gain.

- Set the analogue output zero.

Press the  button to return to the home page.

Press the  button to access the function menu page.

Press the  button to advance to the next page.

STATUS

Press the **Status** icon on the function menu page to access the Status page. This page displays read-only diagnose information on the gauge.

| Status | 1/2 | Status | 2/2 |
|--------------------------|-------|------------------------|------------|
| Laser temperature [°C]: | 0.0 | Gauge core ver: | 0.00 |
| Heating state [%]: | 00 | Gauge application ver: | 0.00 |
| APD temperature [°C]: | 0.0 | Gauge software date: | 00-00-0000 |
| SNR: | 0 | CDI4 software ver: | 2.04 |
| FFT amplitude: | 0.00 | CDI4 software date: | 31-12-2013 |
| DC level [mV]: | 0 | | |
| APD bias voltage [V]: | 0.0 | | |
| Signal amplitude [%]: | 0 | | |
| Filter band: | 1 | | |
| Frequency [KHz]: | 0.000 | | |
| Bragg temperature [°C]: | 0.0 | | |
| Bragg heating state [%]: | 00 | | |

ACCESS LEVELS

Press the **Access levels** icon on the function menu page to enter the access levels page 1. Input the password "18018" to enter the access levels page 2 then select to lock or unlock the respective pages.

| Access levels | 1/1 | Access levels | 1/1 |
|---------------|-------|--------------------|----------|
| Password: | 00000 | Home Pages: | Unlocked |
| | | Measurement pages: | Unlocked |
| | | Comms pages: | Unlocked |
| | | Interface pages: | Unlocked |

STANDARD COMMUNICATIONS INTERFACES

CAN-BUS COMMUNICATIONS

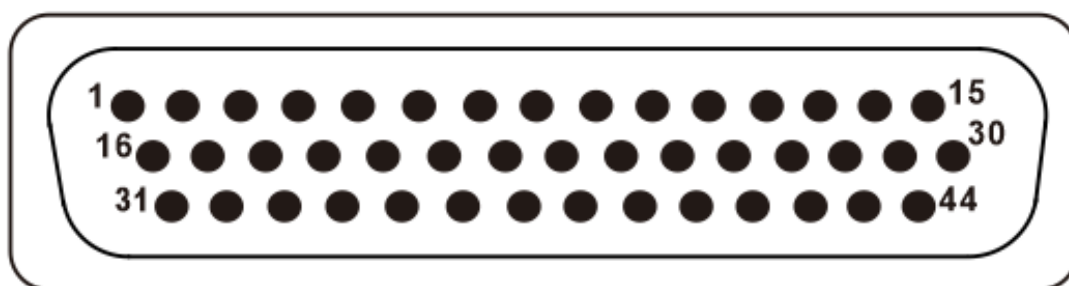
This CAN-bus interface is fitted as standard. It operates independently of the other communications interfaces and may be accessed at the same time as them.

The CAN-bus interface uses a proprietary Proton Products protocol. It is exclusively used to communicate between the unit and other Proton Products modules. The unit automatically detects connection to other modules and configures the bus appropriately; it is not normally necessary to manually configure this interface.

The CAN-bus interface is not intended for use with an external CAN-bus network.

CAN-bus interface


The CAN-bus interface may be accessed through the following pins:



Connector type: DB44 male (socket)

| Functional group | Pin | Designation | Description | Notes |
|--------------------------------|-----|-------------|--------------------|--|
| Shield | S | Shield | Shield | Ensure that the cable shield is connected to the plug shield connection. |
| Power supply and signal ground | 1 | +24V | +24V power supply | |
| | 2 | SUPPLY | | |
| | 3 | DGND | Signal ground (0V) | |
| | 4 | | | |
| CANbus | 5 | CAN H | CANbus high | |
| | 6 | CAN L | CANbus low | |

CAN-bus LED indicator

| CAN |  | LED status | Indication |
|------------------------|---|----------------|---------------------|
| | | Flashing green | Online |
| CAN-bus communications | | Flashing red | Communication error |
| | | Extinguished | No communication |

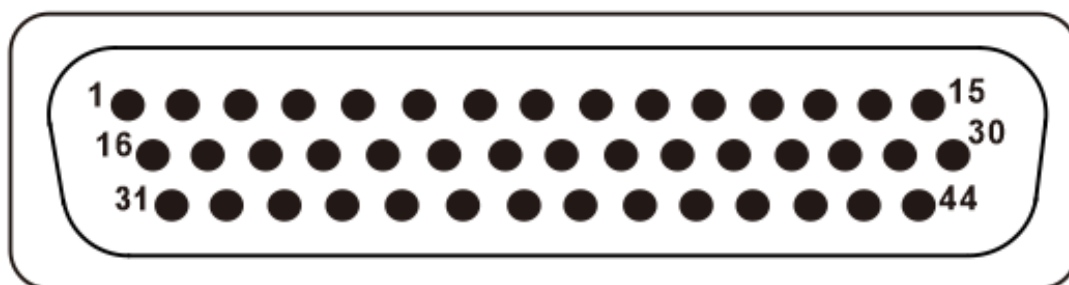
RS-232 COMMUNICATIONS

This RS-232 interface is fitted as standard. It operates independently of the other communications interfaces and may be accessed at the same time as them.

If the RS-232 interface “Mode” is set to “ZM400 Printer”, then a Zebra ZM400 printer may be connected to the port to print reel report tickets when triggered by the “End of Reel” logic input.

RS-232 interface

The RS-232 interface may be accessed through the following pins:



Connector type: DB44 male (socket)

| Functional group | Pin | Designation | Description | Notes | PC DB9 serial port pin |
|--------------------------------|-----|-------------|-------------------------------------|--|------------------------|
| Shield | S | Shield | Shield | Connect to cable and connector shields | Shield |
| Power supply and signal ground | 1 | +24V SUPPLY | +24V power supply | | |
| | 2 | | | | |
| | 3 | | | | |
| | 4 | DGND | Power supply and signal ground (0V) | | 5 |
| | 15 | | | | |
| RS-232 | 11 | RXD | RS-232 receive | | 3 |
| | 12 | TXD | RS-232 transmit | | 2 |
| | 13 | CTS | | | |
| | 14 | RTS | | | |

The above table also shows the configuration of a cable for connection to a personal computer (PC) type DB9 serial port.

The maximum baud rate depends on the cable capacitance and length. For low-cost overall shielded cable with total capacitance of shield to core-plus-core to core of 300pF per metre, the maximum recommended baud rates are as follows:

| Cable length range / m | | Maximum Baud rate / s |
|------------------------|----|-----------------------|
| 0 | 3 | 115200 |
| 3 | 10 | 38400 |
| 10 | 20 | 19200 |
| 20 | 40 | 9600 |
| 40 | 80 | 4800 |

RS-232 Printing

If the RS-232 interface “Mode” is set to “Print”, then a Zebra ZM400 printer may be connected to the port to print End of Reel report tickets when triggered by the “End of Reel” logic input (see the “Logic Inputs” section for connection and configuration information).

Ensure that the RS-232 baud rate is configured to the same value as set on the printer (9600 by default).

Zebra ZM400 Cable

The gauge may either be directly connected to the printer via the DB44M “INTERFACE” port or via the DB9F RS-232 port on an optional PSU-BOB:

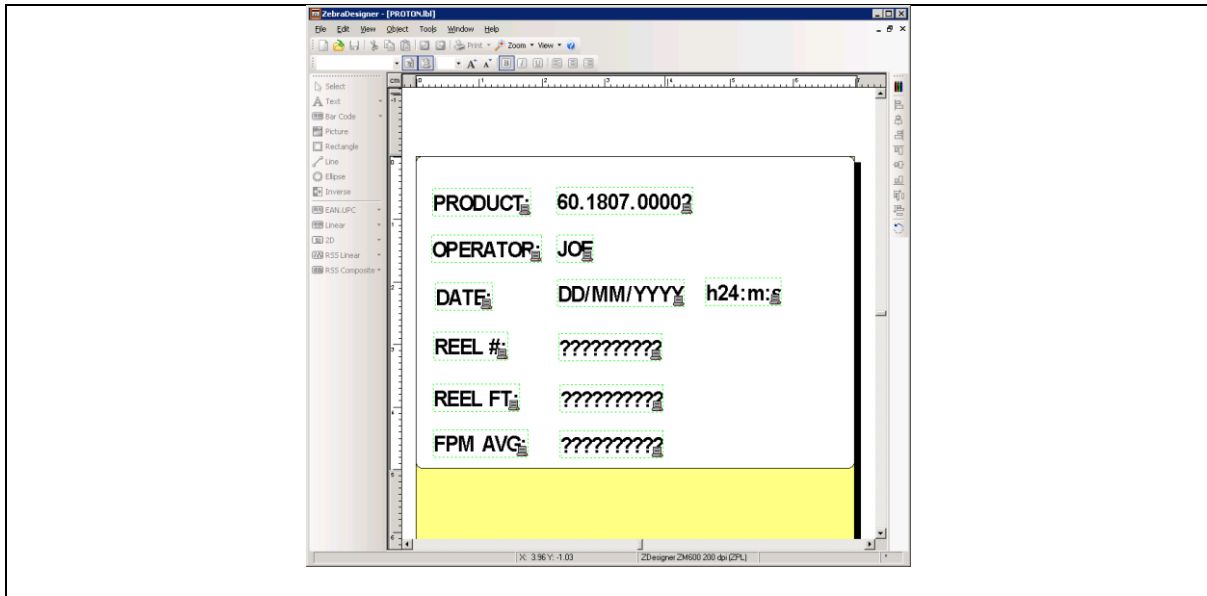
| SL / SLR mini-W INTERFACE port | | Zebra ZM400 RS-232 port | |
|---------------------------------|--------|--------------------------------|-------------|
| Required cable connector: DB44M | | Required cable connector: DB9M | |
| Designation | Pin | Pin | Designation |
| Shield | Shield | Shield | Shield |
| DGND | 15 | 5 | DGND |
| RXD | 11 | 3 | TXD |
| TXD | 12 | 2 | RXD |

| PSU-BOB RS-232 port | | Zebra ZM400 RS-232 port | |
|--------------------------------|--------|--------------------------------|-------------|
| Required cable connector: DB9M | | Required cable connector: DB9M | |
| Designation | Pin | Pin | Designation |
| Shield | Shield | Shield | Shield |
| DGND | 5 | 5 | DGND |
| RXD | 2 | 3 | TXD |
| TXD | 3 | 2 | RXD |

Zebra ZM400 Printer Configuration

The Zebra ZM400 printer must be configured with the layout of the End of Reel report ticket using the following procedure:

| | |
|---|--|
| 1 | Install the “Zebra Designer” software onto a suitable PC. |
| 2 | Install the Zebra printer drivers onto the PC (the drivers are supplied on a CD-ROM with the Zebra ZM400 printer and may also be downloaded from www.zebra.com). |
| 3 | Connect the PC to the Zebra ZM400 printer using the USB cable supplied with the printer. |
| 4 | Run the “Zebra Designer” software and open the “PROTON.lbl” sample label layout file: |

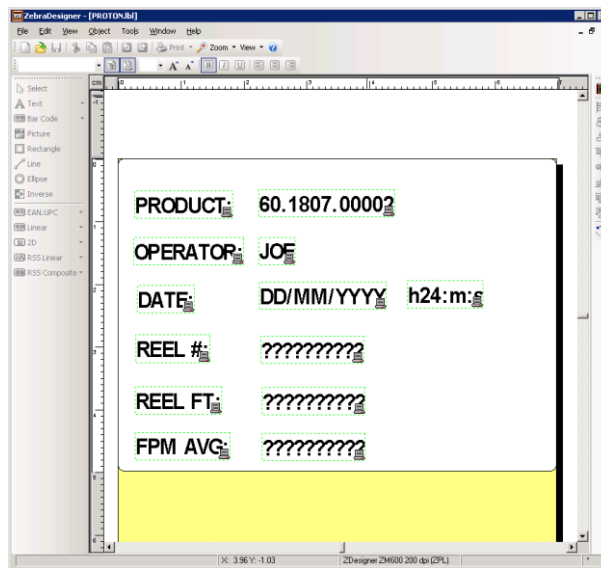


5

The gauge will send 3 strings in the following sequence to the Zebra ZM400 printer:

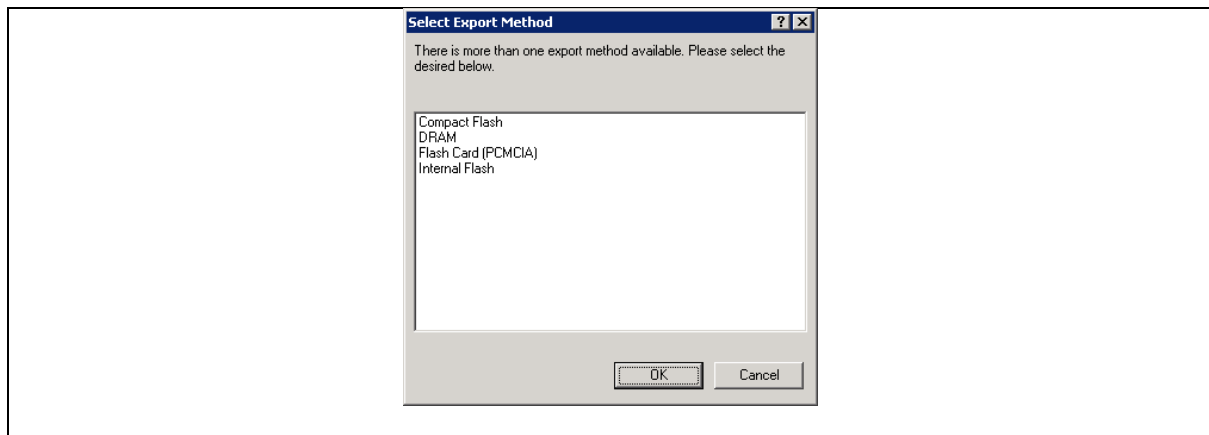
- String no.1: Reel number
- String no.2: Length
- String no.3: Average speed

The label layout must be designed to accommodate the above 3 strings in sequence:



6

Export the "PROTON.lbl" file to the Zebra ZM400 printer by clicking "File → Export to Printer" in the "Zebra Designer" software and then selecting "Internal Flash" and clicking the "OK" button:



| | |
|---|--|
| 7 | The Zebra ZM400 printer may be triggered to print a ticket by activating the “End of Reel” logic input on the SL / SLR mini-W gauge. |
|---|--|

Proton standard RS232 parameter access protocol

This uses a protocol to access individual parameters or blocks of parameters and is typically used in a production line environment where the gauge is connected to a PLC or similar device.

Notes

- The parameters are split into 'Input' and 'Output' groups, the 'Input' parameters can be both read and written, and the 'Output' parameters can only be read
- The parameter number is the same as the word address used for Profibus data; refer to the 'PROFIBUS Master to Gauge and RS232 Input Parameter List' for the parameter numbers
- For 'Input' data: when a word is defined as bits then four hexadecimal characters are required to form the bits 15~0; when a word is defined as a data value then only sufficient characters to define the value in decimal format, with the decimal point where appropriate, are needed; where the data is of double word length then only the first word address is used
- For 'Output' data: when a word is defined as bits then four hexadecimal characters will be sent; when a word is defined as a data value it is converted to a decimal number with the decimal point but without leading zeros; where a double word is used then only the first word address is used to request the data, the data in both words is automatically converted to a single value
- If a PC keyboard is being used to enter the codes then the 'carriage return' plus 'line feed' are replaced by the Enter key

SET THE VALUE OF AN 'INPUT' PARAMETER

Write Format:

&
Input Parameter number
Space
Value without decimal point [0.5m = 50]
Carriage return
Line feed

REQUEST VALUE ONCE FOR ONE OR A RANGE OF 'INPUT' PARAMETERS

Request Format 1: (e.g.: ?2 'ENTER')

?
Input Parameter number
Carriage return
Line feed

Request Format 2: (e.g.: ?2 2 'ENTER')

?
Input Parameter number
Space
Length of string
Carriage return
Line feed

REQUEST CONTINUOUSLY REPEATING VALUES FOR ONE OR A RANGE OF 'OUTPUT' PARAMETERS

The repartition rate is the maximum possible and only limited by the data length and baud rate. The parameters must be consecutive when requesting multiple parameters.

Request Format 1:

Parameter number
Carriage return
Line feed

Request Format 2:

First parameter number
Space
Number of parameters
Carriage return
Line feed

Reply Format 1:

Parameter value
Carriage return
Line feed

Reply Format 2:

First output parameter value
Carriage return
Line feed
Second output parameter value
Carriage return
Line feed
Third output parameter and so on, until the end of the range.

REQUEST VALUE ONCE FOR ONE OR A RANGE OF 'OUTPUT' PARAMETERS

The request and reply format is identical to the # format given below except that # is replaced by ~.

Modbus parameter access protocol

This protocol provides access to individual parameters or blocks of parameters and is typically used in a production environment where the Proton Products instrument is connected to a computer, Modbus connected PLC or similar device.

The parameters consist of 16-bit words (DW) and are divided into input and output groups:

- Input parameters may be read from and written to and are used to configure the instrument.
- Output parameters are read only and provide access to instrument status and measurement data.

| |
|--|
| 1 word (DW) consists of 2 bytes |
| 1 byte consists of 8 bits |
| 4 bits are expressed by 1 hexadecimal digit (0-9, A-F) |

Proton Products instruments use the following Modbus format:

| | |
|----------------------|-------------------------------|
| Modbus format | RTU (Remote Terminal Unit) |
| Error check | CRC (Cyclic Redundancy Check) |

The Modbus RTU frame format is as follows:

| Modbus RTU frame format | | | |
|-------------------------|------------------|---|---|
| Name | Length | Function | |
| Start | > 3.5 characters | >3.5 characters of silence | |
| Address | 1-byte | Slave (instrument) Modbus address | * |
| Function | 1-byte | Modbus function code determines read or write operation | * |
| Data | Multiple bytes | Length and data dependent on function | * |
| CRC | 2-bytes | Cyclic Redundancy Check for errors (not required for Modbus TCP)* | |
| End | > 3.5 characters | >3.5 characters of silence | |

*Please refer to Modbus Protocol Standards documentation for the CRC error check field calculation. For Modbus protocol communications over TCP/IP networks via the Ethernet port (also known as **Modbus TCP**), the CRC error check field is not required as error checking is handled by the TCP/IP protocol.

For brevity, only the fields marked * are shown in the subsequent examples.

Proton Products instruments support the following Modbus functions:

| Modbus function | | | Instrument operation |
|-----------------|-----|---------------------------|---|
| Code | | Name | |
| Dec | Hex | | |
| 03 | 03 | Read Holding Registers | Read data from a block of consecutive input parameters. |
| 06 | 06 | Preset Single Register | Write data to a single input parameter. |
| 16 | 10 | Preset Multiple Registers | Write data to a block of consecutive input parameters. |
| 04 | 04 | Read Input Registers | Read data from a block of consecutive output parameters. |

For Modbus protocol communications via the RS-232 serial port, the RS-232 data format is:

| Number of data bits | Parity | Number of stop bits | Flow control | Default baud rate |
|---------------------|--------|---------------------|--------------|-------------------|
| 8 | None | 1 | None | 115200 bit / s |

Read data from a block of consecutive input parameters

Use Modbus function “03” (Read Holding Registers) to read from a block of consecutive input parameters.

| Modbus query format | | Hex |
|--|-----------|-----|
| Slave Modbus address (Gauge Modbus address) | | 01 |
| Modbus function code | | 03 |
| Starting address (Starting input parameter address) | High byte | 00 |
| | Low byte | 08 |
| Number of points (Input parameter word count) | High byte | 00 |
| | Low byte | 04 |

| Modbus response format | | Hex |
|--|-----------|-----|
| Slave Modbus address (Gauge Modbus address) | | 01 |
| Modbus function code | | 03 |
| Byte count $N = (2 \times \text{Number of points})$ | | 08 |
| Data word 0 (corresponds to input DW8) | High byte | 01 |
| | Low byte | F4 |
| Data word 1 (corresponds to input DW9) | High byte | 01 |
| | Low byte | F4 |
| Data word 2 (corresponds to input DW10) | High byte | 01 |
| | Low byte | F4 |
| Data word $[(N/2) - 1] = 3$ (corresponds to input DW11) | High byte | 01 |
| | Low byte | F4 |

The response contains the input parameter values requested in the query; its length is dependent on the number of input parameters requested.

Write data to a single input parameter

Use Modbus function “06” (Preset Single Register) to read from a block of consecutive input parameters.

| Modbus query format | | Hex |
|--|-----------|-----|
| Slave Modbus address (Gauge Modbus address) | | 01 |
| Modbus function code | | 06 |
| Register address (Input parameter address) | High byte | 00 |
| | Low byte | 06 |
| Preset data (Input parameter value) | High byte | 03 |
| | Low byte | E8 |

| Modbus response format | | Hex |
|--|-----------|-----|
| Slave Modbus address (Gauge Modbus address) | | 01 |
| Modbus function code | | 06 |
| Register address (Input parameter address) | High byte | 00 |
| | Low byte | 06 |
| Preset data (Input parameter value) | High byte | 03 |
| | Low byte | E8 |

The response is an echo of the query.

Write data to a block of consecutive input parameters

Use Modbus function “16 (10 Hex)” (Preset Multiple Registers) to write to a block of consecutive input parameters.

| Modbus query format | | Hex |
|---|--------------|-----|
| Slave Modbus address (Gauge Modbus address) | | 01 |
| Modbus function code | | 10 |
| Starting address (Starting input parameter address) | High byte | 00 |
| | Low byte | 01 |
| Number of registers (Input parameter word count) | High byte | 00 |
| | Low byte | 03 |
| Byte count $N = (2 \times \text{Number of registers})$ | | 06 |
| Data word 0 (corresponds to input DW1) | High byte | 1F |
| | Low byte | 40 |
| Data word 1 (corresponds to input DW2) | High byte | 1F |
| | Low byte | 40 |
| Data word $[(N/2) - 1] = 2$ (corresponds to input DW3) | High byte | 1F |
| | Low byte | 40 |

| Modbus response format | | Hex |
|---|--------------|-----|
| Slave Modbus address (Gauge Modbus address) | | 01 |
| Modbus function code | | 10 |
| Starting address (Starting input parameter address) | High byte | 00 |
| | Low byte | 01 |
| Number of registers (Input parameter word count) | High byte | 00 |
| | Low byte | 03 |

The response contains the starting input parameter address and the count of input parameter words written.

Read data from a block of consecutive output parameters

Use Modbus function “04” (Read Input Registers) to write to a block of consecutive input parameters.

| Modbus query format | | Hex |
|--|--------------|-----|
| Slave Modbus address (Gauge Modbus address) | | 01 |
| Modbus function code | | 04 |
| Starting address (Starting output parameter address) | High byte | 00 |
| | Low byte | 02 |
| Number of points (Output parameter word count) | High byte | 00 |
| | Low byte | 03 |

| Modbus response format | | Hex |
|---|--------------|-----|
| Slave Modbus address (Gauge Modbus address) | | 01 |
| Modbus function code | | 04 |
| Byte count $N = (2 \times \text{Number of points})$ | | 06 |
| Data word 0 (corresponds to output DW2) | High byte | 07 |
| | Low byte | D0 |
| Data word 1 (corresponds to output DW3) | High byte | 05 |
| | Low byte | DC |
| Data word 2 [(N/2) – 1] (corresponds to output DW4) | High byte | 09 |
| | Low byte | C4 |

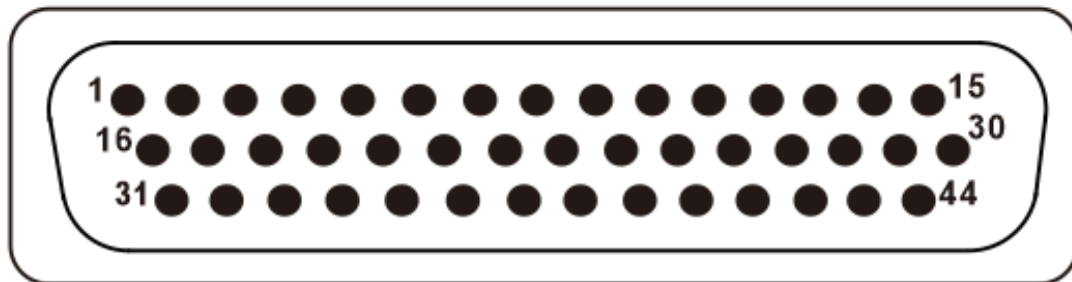
The response contains the output parameter values requested in the query; its length is dependent on the number of output parameters requested.

PROFIBUS COMMUNICATIONS

This communications interface operates independently of the other communications interfaces and may be used at the same time as them.

PROFIBUS interface

The PROFIBUS interface may be accessed through the following pins:



Connector type: DB44 male (socket)

| Functional group | Pin | Designation | Description | Notes |
|-------------------------|-----|-------------|-------------|-----------------------------------|
| Shield | S | Shield | Shield | Connect to cable and plug shields |
| PROFIBUS Industrial bus | 9 | Vbus | +5V | |
| | 10 | GNDbus | GND | I-bus ground reference |
| | 7 | PROFI A | A | |
| | 8 | PROFI B | B | |

PROFIBUS LED indicator

| i-BUS | | LED status | Indication |
|-------------------------|--|------------------|---------------------|
| | | Continuous green | Online |
| PROFIBUS communications | | Continuous red | Communication error |
| | | Extinguished | No communication |

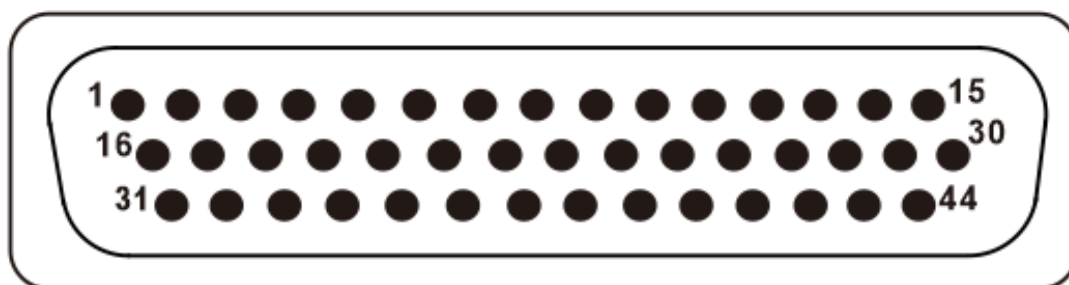
ETHERNET / IP OR PROFINET COMMUNICATIONS

The Ethernet/IP interface is compatible with PLCs fitted with an Ethernet/IP interface that supports the CIP (Common Industrial Protocol).

This communications interface operates independently of the other communications interfaces and may be used at the same time as them.

EtherNet / IP or PROFINET interface


The EtherNet / IP or PROFINET interface may be accessed through the following pins:



Connector type: DB44 male (socket)

| Functional group | Pin | Designation | Description | Notes |
|--|-----|-------------|-------------|-----------------------------------|
| Shield | S | Shield | Shield | Connect to cable and plug shields |
| Ethernet/IP or PROFINET Industrial bus | 16 | ETH TX+ | TX+ | |
| | 17 | ETH TX- | TX- | |
| | 18 | ETH RX+ | RX+ | |
| | 19 | ETH RX- | RX- | |

EtherNet / IP or PROFINET LED indicator

| i-BUS |  | LED status | Indication |
|--|---|------------------|---------------------|
| | | Continuous green | Online |
| EtherNet / IP or PROFINET communications | | Continuous red | Communication error |
| | | Extinguished | No communication |

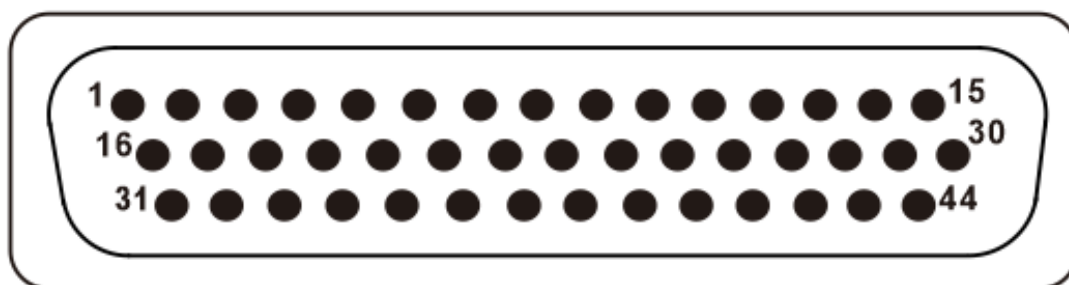
ETHERNET COMMUNICATIONS

This Ethernet interface is fitted as standard. It operates independently of the other communications interfaces and may be accessed at the same time as them.

If an optional industrial bus interface (Ethernet/IP, PROFIBUS or Profinet) has been installed in the gauge, then the Ethernet interface is substituted by the industrial bus interface.

Ethernet interface


The Ethernet interface may be accessed through the following pins:



Connector type: DB44 male (socket)

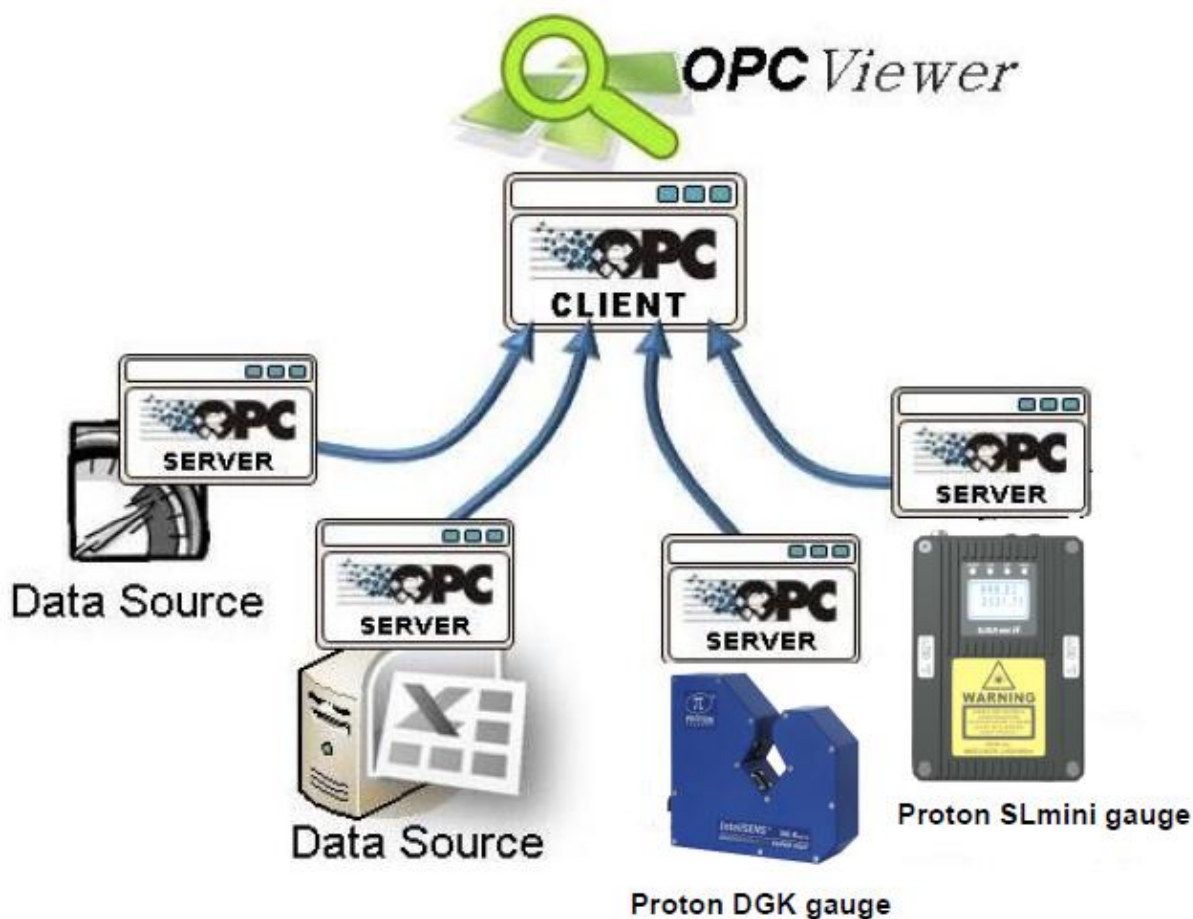
| Functional group | Pin | Designation | Description | Notes |
|------------------|-----|-------------|-------------|-----------------------------------|
| Shield | S | Shield | Shield | Connect to cable and plug shields |
| Ethernet | 16 | TX+ | | |
| | 17 | TX- | | |
| | 18 | RX+ | | |
| | 19 | RX- | | |

Ethernet LED indicator

| EIP |  | LED status | Indication |
|-------------------------|---|------------------|--------------------------|
| | | Continuous green | Online and connected |
| Ethernet communications | | Flashing green | Online but not connected |
| | | Continuous red | Critical link failure |
| | | Flashing red | Connection timeout |

OPC UNIFIED ARCHITECTURE (UA)

OPC UA is a central element of Industry 4.0 providing seamless communication between IT and industrial production systems. OPC UA 1.03 has been supported on Proton SLmini gauge as a standard interface. The OPC Client can exchange data (read / write) with SLmini gauge (OPC Server) to real-time monitor and manage the gauge.

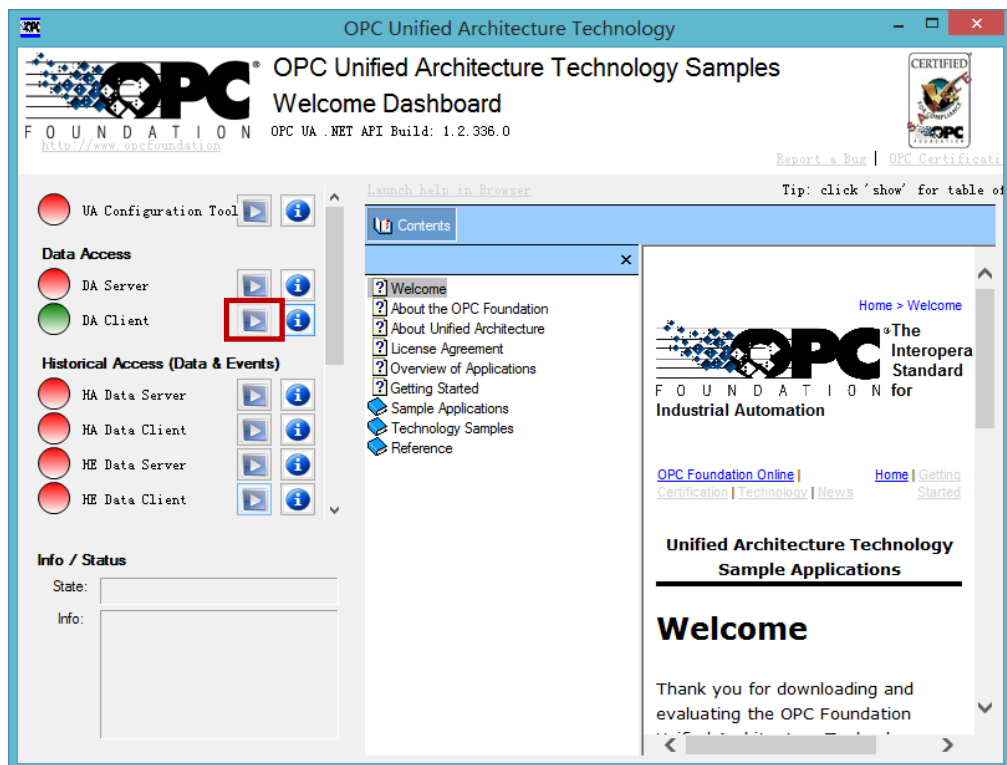


To connect to the SLmini gauge (OPC Server) from an OPC Client software, please use the following procedure:

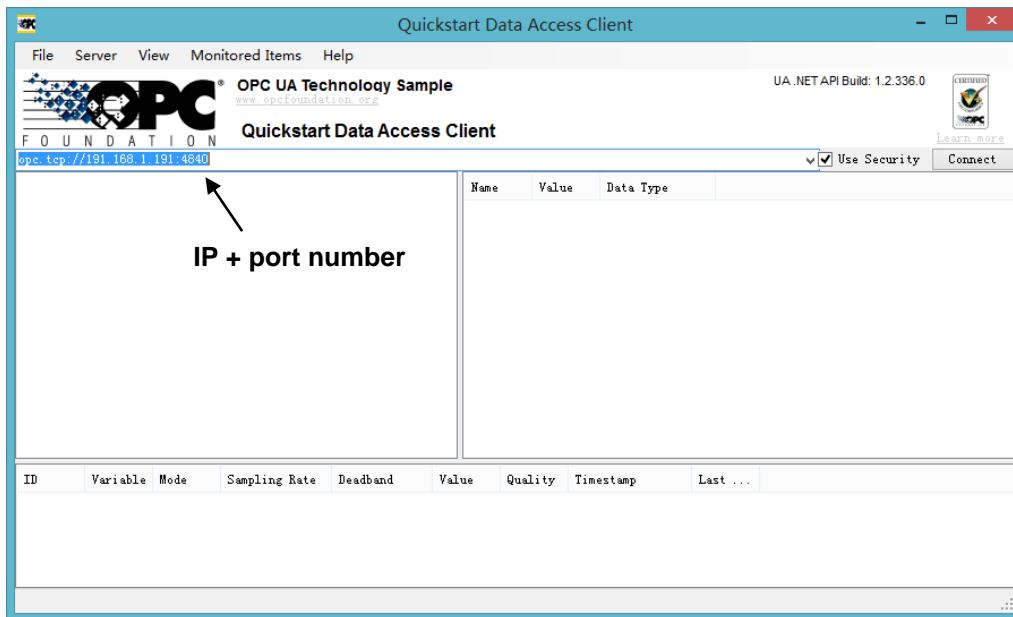
1. Set up the OPC port number, user name and password on PCIS.
Main page > Comms (password: 65000) > OPC

Enter the OPC port number (default: 4840), user name (default: admin) and password (default: admin). If “Anonymous” is ticked, the OPC Client will log in the gauge anonymously.

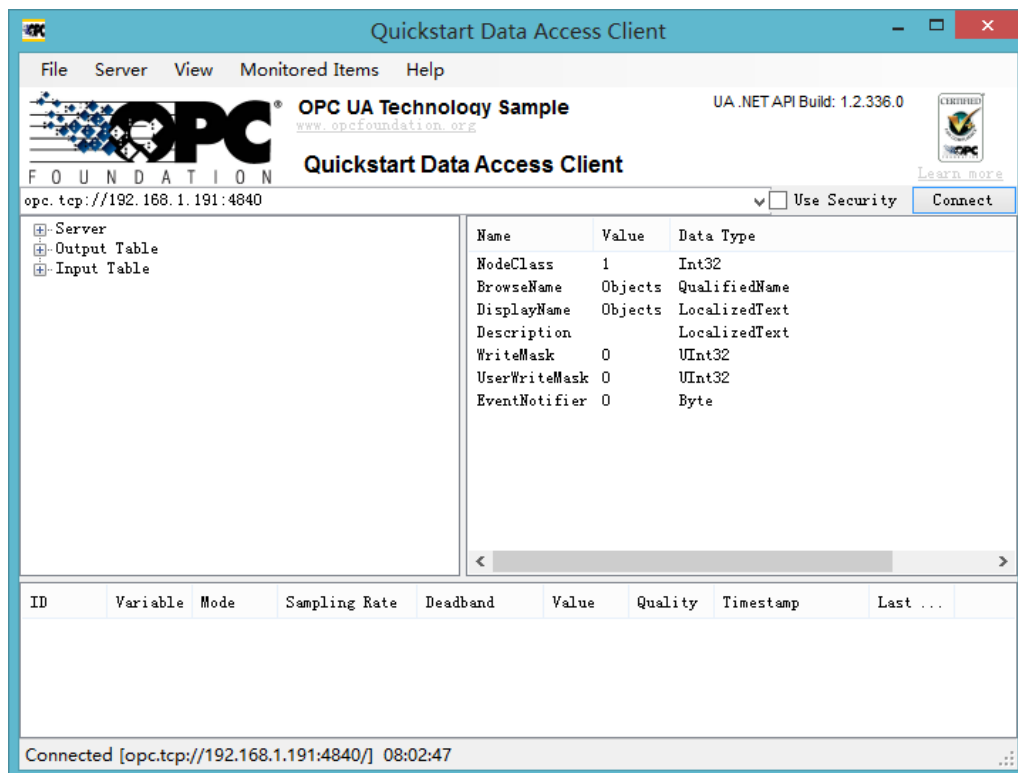
2. Configuration on the OPC Client (take OPC UA Dashboard” as an example. It’s similar for other OPC Client software). Note that only one OPC Client can connect to the gauge at the same time.



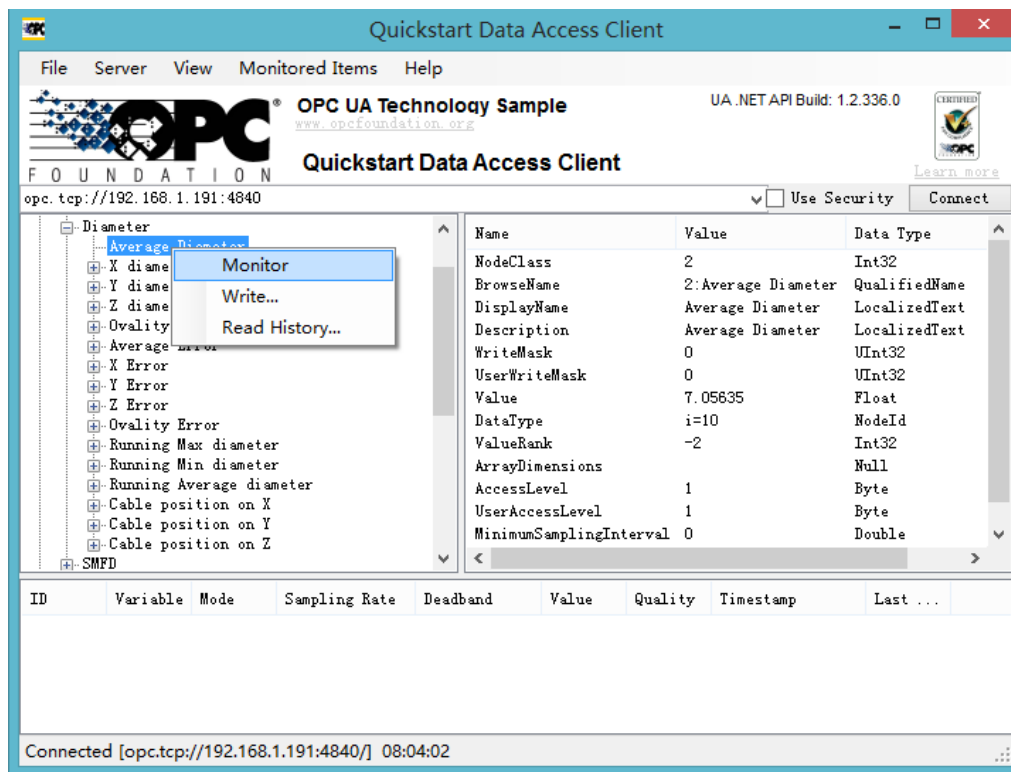
3. Click “DA Client” button to enter the Data Access page.



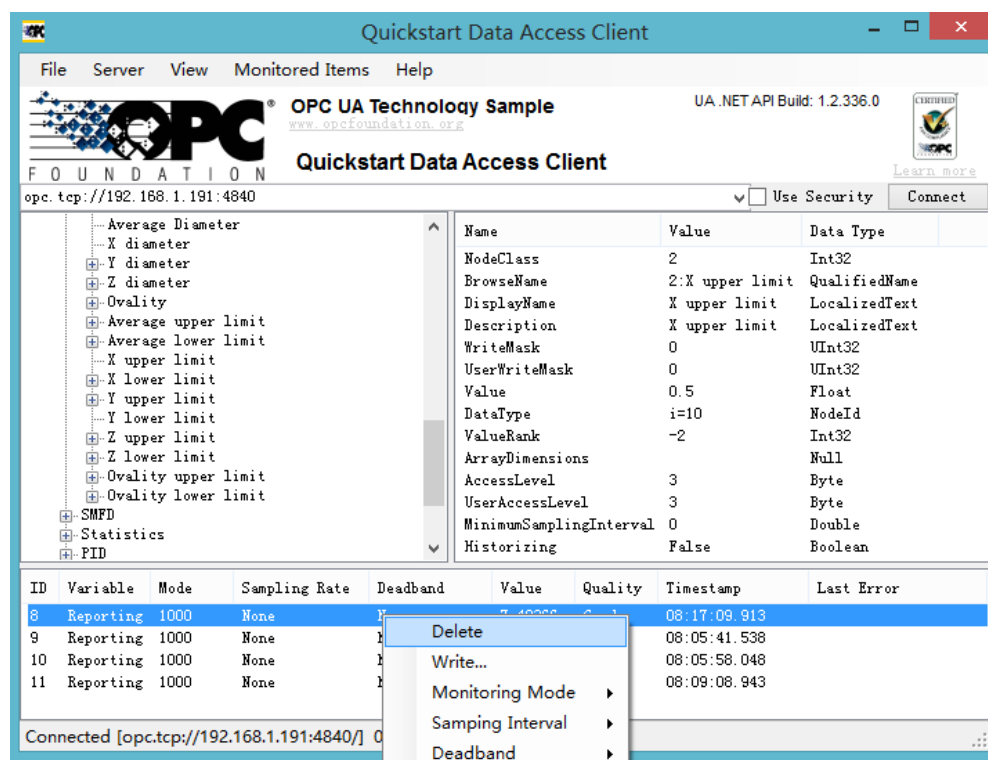
Enter the gauge IP address and port number then click “Connect” button. Note that the IP address should be the same as the one configured on PCIS.



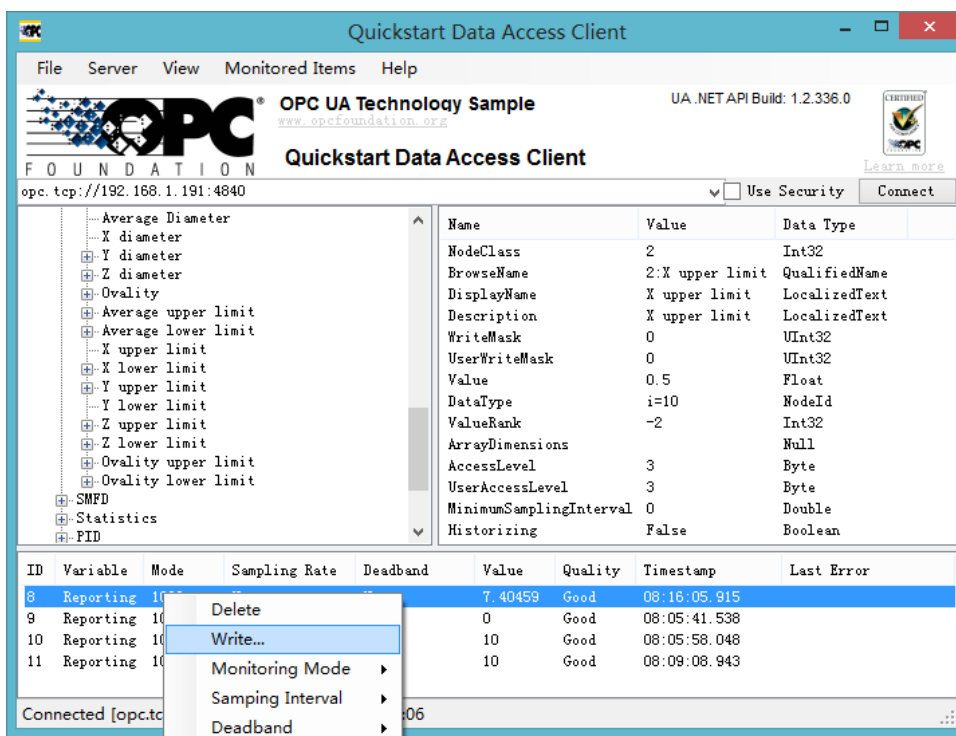
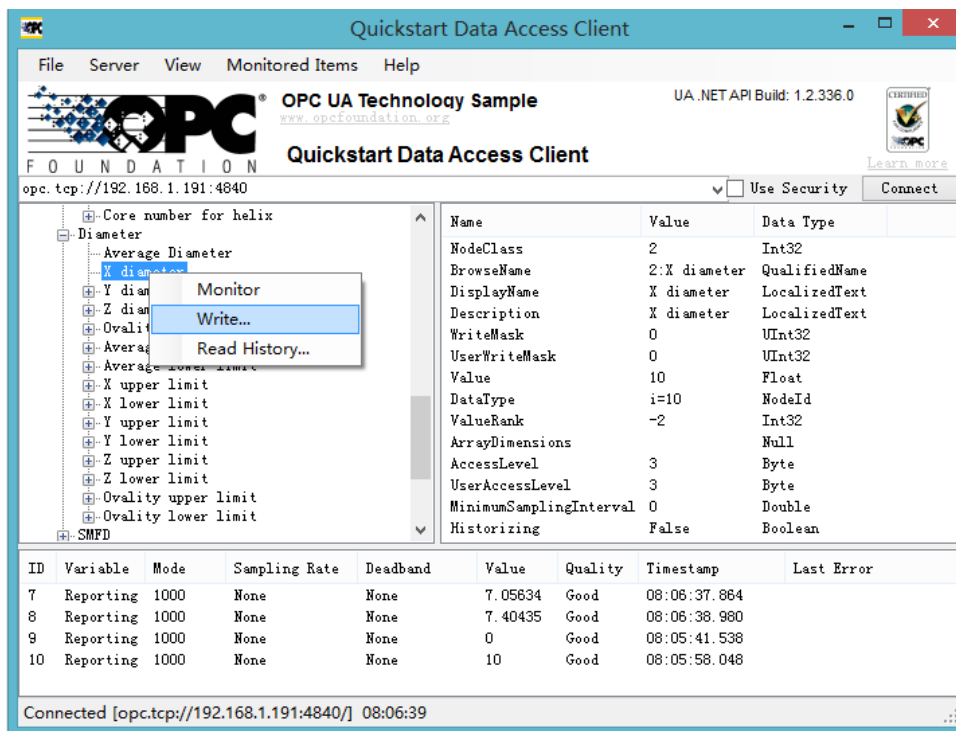
Unfold the parameter list on the left side of the page, right-click and select **Monitor** on the pop-up menu, for example, Average diameter, the parameter will appear in the monitoring list



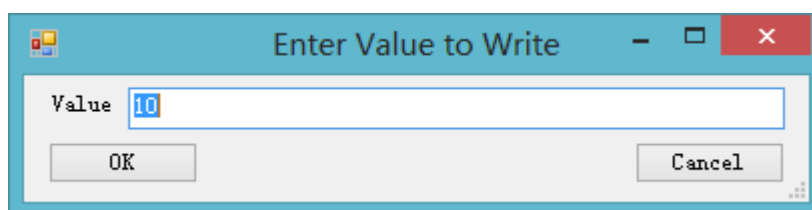
Right-click on the monitored parameter and select **Delete** on the pop-up menu to stop monitoring the parameter.



Right-click and select **Write** on the pop-up menu to write a parameter to the gauge.



Enter the parameter value on the pop-up menu then click “OK” button to confirm.

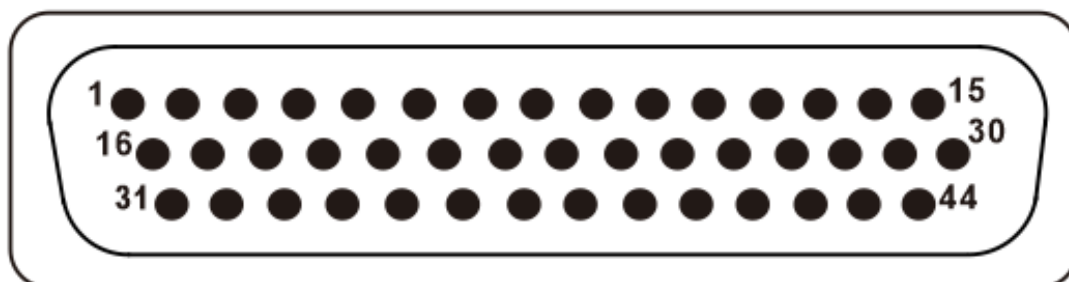


STANDARD ELECTRICAL INTERFACES

LOGIC INPUTS

Logic inputs connection

Three logic inputs are fitted as standard and may be accessed through the following pins:



Connector type: DB44 male (socket)

| Functional group | Pin | Designation | Description | Notes |
|------------------|-----|-------------|--------------------|---|
| Shield | S | Shield | Shield | Connect to cable and plug shields |
| Digital ground | 34 | DGND | Signal ground (0V) | Logic input ground reference |
| Logic inputs | 31 | LIN1 | Logic input 1 | Low state (logic 0) voltage < +3V High state (logic 1) voltage > +10.5V Maximum input voltage $\pm 30V$ |
| | 32 | LIN2 | Logic input 2 | |
| | 33 | LIN3 | Logic input 3 | |

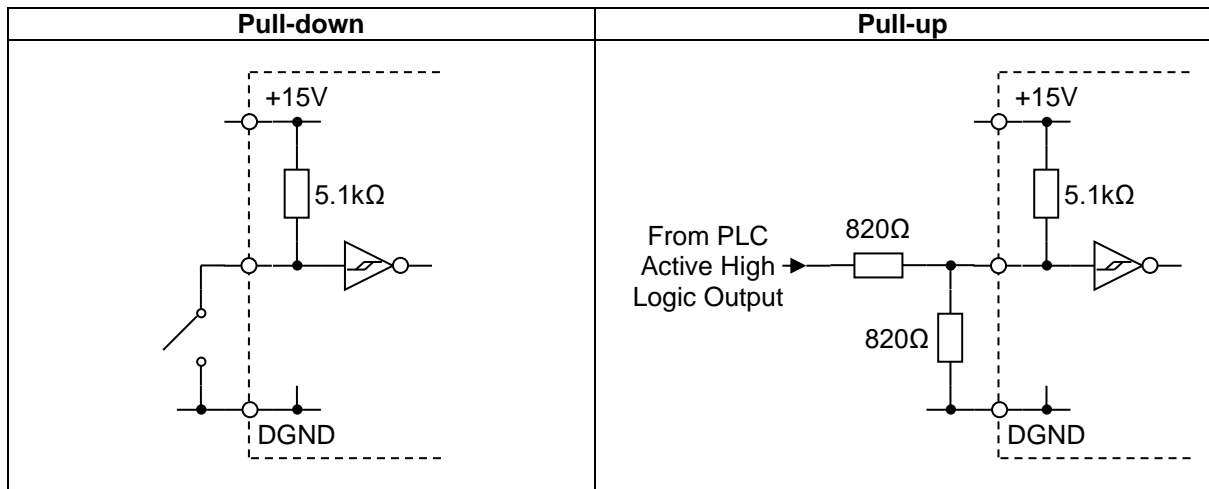
Logic inputs electrical specification

- Logic inputs are NOT isolated from earth.
- Inputs are internally pulled up to +15V via 8.2k Ω resistors; unconnected inputs default to the high state.
- Inputs will source a minimum current of 3mA when externally pulled down to the low state.

| Specification | Minimum | Typical | Maximum | Units |
|------------------------------------|---------|---------|---------|-------|
| Low state (logic 0) input voltage | | | 3 | V |
| High state (logic 1) input voltage | 10.5 | | | V |
| Absolute input voltage | -30 | | 30 | V |
| Low state source current | 3 | | | mA |

Logic inputs can be connected to different types of signal sources as follows:

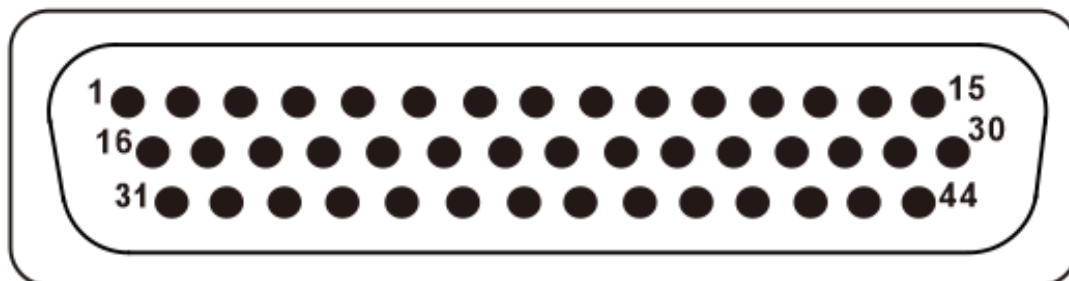
| Signal source | Connection method |
|---|--|
| Mechanical or solid state relay contact | Connect between logic input and DGND. |
| Pull-down | Connect the pull-down signal to the logic input and ground to DGND. |
| Pull-up | <ul style="list-style-type: none">• Connect an 820Ω resistor between the logic input and DGND to pull the input down to 2.5V.• Connect the pull-up signal source to the logic input and ground to DGND.• For 24V signals (such as from a PLC), the power dissipation in the 820Ω resistor can be reduced by connecting another 820Ω in series between the pull-up signal source and logic input. |



LOGIC OUTPUTS

Logic outputs connection

Three outputs are fitted as standard and may be accessed through the following pins:



Connector type: DB44 male (socket)

| Functional group | Pin | Designation | Description | Notes | |
|------------------|-----|-------------|--------------------|---|---------------------|
| Shield | S | Shield | Shield | Connect to cable and plug shields | |
| Digital ground | 28 | DGND | Signal ground (0V) | Floating (inactive) or pull-down to DGND (active) | |
| Logic outputs | 24 | LOP1 | Logic output 1 | State | Output |
| | | | | Inactive | Floating |
| | | | | Active | Pulled down to DGND |
| | 25 | LOP2 | Logic output 2 | State | Output |
| | | | | Inactive | Floating |
| | | | | Active | Pulled down to DGND |
| | 26 | LOP3 | Logic output 3 | State | Output |
| | | | | Inactive | Floating |
| | | | | Active | Pulled down to DGND |

Logic outputs electrical specifications

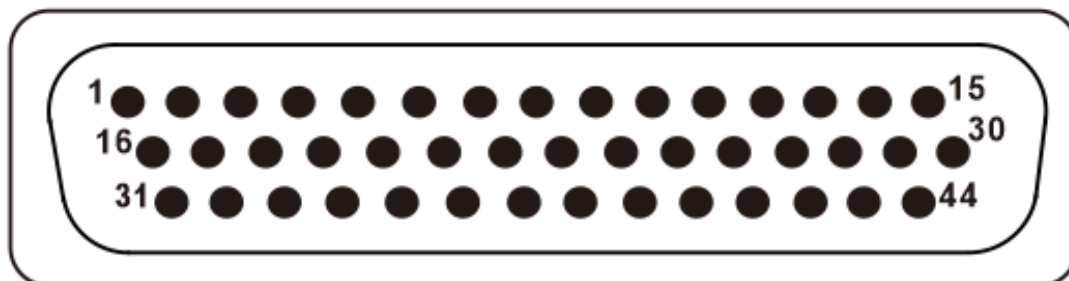
- The logic outputs must NOT be used to directly drive high-current or inductive loads.
- It is recommended that the logic outputs are used to drive opto-isolated solid-state relays.

| Specification | Minimum | Typical | Maximum | Units |
|------------------------------|---------|---------|---------|-------|
| Logic output to DGND voltage | | | +25 | VDC |
| Current | | | 0.1 | A |

PULSE OUTPUTS

Pulse outputs connection



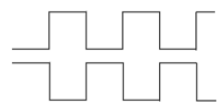
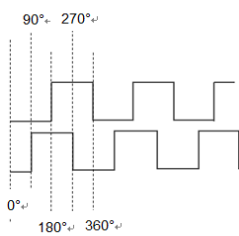
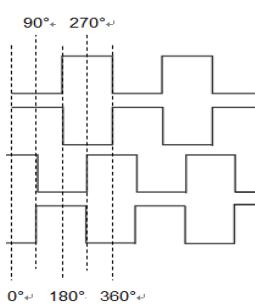


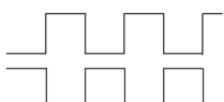
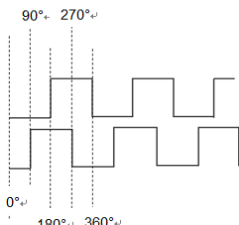
Four pulse outputs are fitted as standard and may be accessed through the following pins:



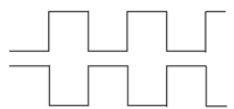
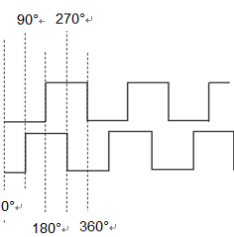


Connector type: DB44 male (socket)

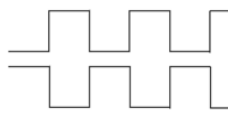

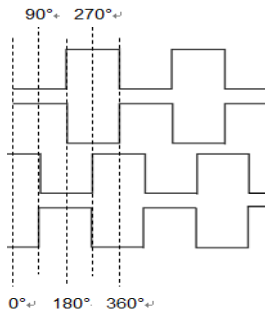
| Functional group | Pin | Designation | Description | Notes |
|-------------------------|-----|-------------|------------------------------------|--|
| Pulse outputs | 43 | POUT +V | Pulse output external power supply | If no external power supply is connected, then the pulse outputs default to the internal +5V supply. Maximum voltage: +24V |
| | 37 | P1 | Pulse output 1 | RS-422 compliant differential pair pulse outputs. |
| | 38 | P2 | Pulse output 2 | |
| | 39 | P3 | Pulse output 3 | RS-422 compliant differential pair pulse outputs. |
| | 40 | P4 | Pulse output 4 | |
| | 41 | P5 | Pulse output 5 | RS-422 compliant differential pair pulse outputs. |
| | 42 | P6 | Pulse output 6 | |
| Power supply and ground | 1 | +24V | Power supply | For 24V pulse outputs, connect this pin to POUT +V. |
| | 2 | | | |
| | 3 | DGND | Power supply ground reference | |
| | 4 | | | |
| Shield | S | Shield | Shield | Connect to cable and plug shields |

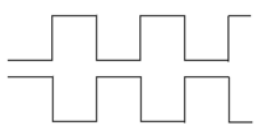
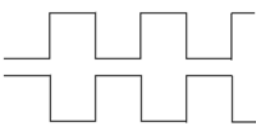
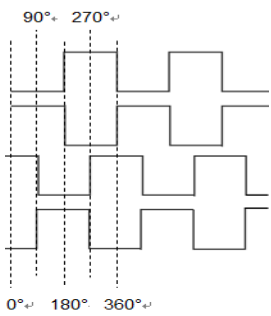
PULSE OUTPUTS ON SL MINI-W AND ON PSU-BOB

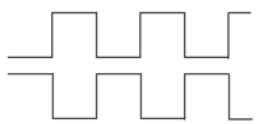
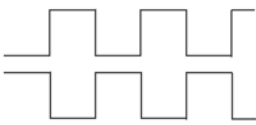
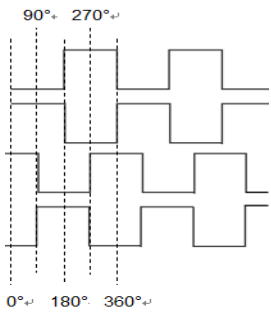
| Pulse outputs on SL mini-W gauge | | | | | |
|----------------------------------|---|----|-----------------------|--|----------------|
| Options | Pulse outputs | | | | Pulse rate set |
| Pulse Group A | Single end | P1 | Single end |  | P1 |
| | | P2 | Single end |  | P2 |
| | Differential (P1&P2) | P1 | Differential |  | P1 |
| | | P2 | | | |
| | Single end Quadrature (P1, P2) | P1 | Single end Quadrature |  | P1 |
| | | P2 | | | |
| | *Differential Quadrature (P1&P2, P3&P4) | P1 | Differential |  | P1 |
| | | P2 | Differential | | |
| | | P3 | Differential | | |
| | | P4 | Differential | | |
| Pulse Group B | Single end | P3 | Single end |  | P3 |
| | Single end | P4 | Single end |  | P4 |
| | Differential (P3&P4) | P3 | Differential |  | P3 |
| | | P4 | | | |
| | Single end Quadrature (P3, P4) | P3 | Single end Quadrature |  | P3 |

| | | | | | |
|---------------|--------------------------------|----|-----------------------|--|----|
| Pulse Group C | Single end | P5 | Single end |  | P5 |
| | Single end | P6 | Single end |  | P6 |
| | Differential (P5&P6) | P5 | Differential |  | P5 |
| | | P6 | | | |
| | Single end Quadrature (P5, P6) | P5 | Single end Quadrature |  | P5 |

Pulse outputs on PSU-BOB

| Options | | Pulse outputs | | | Pulse rate set | | |
|---------------|--|-----------------------------------|------------------|-------------------------|--|----|--|
| Pulse Group A | Single end | P1 | Differential | |  | P1 | |
| | | /P1 | | | | | |
| | | P2 | Differential | |  | P2 | |
| | | /P2 | | | | | |
| | Differential (P1&P2) | Used when PSU-BOB is not provided | | | | | |
| | Single end Quadrature (P1, P2) | P1 | Differential | Differential Quadrature |  | P1 | |
| | | /P1 | | | | | |
| | | P2 | 90° Differential | | | | |
| | | /P2 | | | | | |
| | Differential Quadrature (P1&P2, P3&P4) | Used when PSU-BOB is not provided | | | | | |

| | | | | | | |
|---------------|--------------------------------|-----------------|-----------------------------------|--|--|--|
| Pulse Group B | Single end | P3 | Differential | |  | P3 |
| | | /P3 | | | | |
| | | P4 | Differential | |  | P4 |
| | | /P4 | | | | |
| | Differential (P3&P4) | | Used when PSU-BOB is not provided | | | |
| | Single end Quadrature (P3, P4) | P3 | Differential | | Differential Quadrature |  |
| /P3 | | | | | | |
| P4 | | 90°Differential | | | | |
| /P4 | | | | | | |

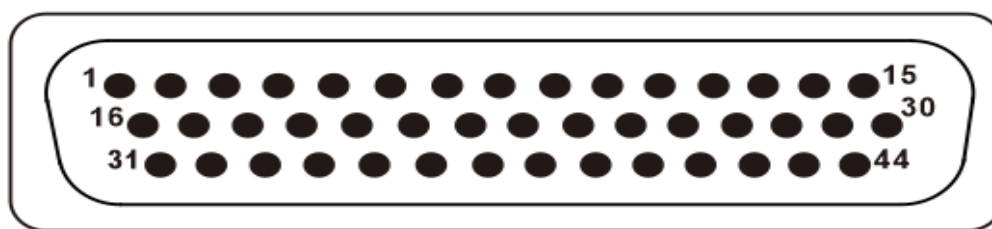
| | | | | | | |
|---------------|--------------------------------|-----------------|-----------------------------------|--|--|--|
| Pulse Group C | Single end | P5 | Differential | |  | P5 |
| | | /P5 | | | | |
| | | P6 | Differential | |  | P6 |
| | | /P6 | | | | |
| | Differential (P5&P6) | | Used when PSU-BOB is not provided | | | |
| | Single end Quadrature (P3, P4) | P5 | Differential | | Differential Quadrature |  |
| /P6 | | | | | | |
| P5 | | 90°Differential | | | | |
| /P6 | | | | | | |

Pulse outputs electrical specifications

| Specification | Minimum | Typical | Maximum | Units |
|--|---------|---------|---------|-------|
| Pulse output external power supply (POUT +V) | +5 | | +25 | VDC |
| Pulse output frequency | | | 1* | MHz |

* reduced with increasing cable length in accordance with RS-422 standards.

CONNECTOR PIN OUTS



Connector type: DB44 male (socket)

| Functional group | Pin | Designation | Description | Notes |
|-----------------------------------|-----|-------------|---|--|
| Logic inputs | 31 | LIN1 | Logic input 1 | Low < +3V; High > +10.5V; Max $\pm 30V$ User configurable function. |
| | 32 | LIN2 | Logic input 2 | |
| | 33 | LIN3 | Logic input 3 | |
| Logic outputs | 24 | LOP1 | Logic output 1 | Floating or pull-down; user configurable function. |
| | 25 | LOP2 | Logic output 2 | |
| | 26 | LOP3 | Logic output 3 | |
| CANbus | 5 | CAN H | CANbus high | For connection to Proton Products accessories. |
| | 6 | CAN L | CANbus low | |
| Laser safety | 27 | SHUT_ST | Shutter status | Pulled down to DGND when the shutter is open. |
| | 30 | /SHUT_EN | Shutter control | Pull down to DGND to open the laser shutter. |
| | 29 | /LSR_EN | Laser enable | Pull down to DGND to enable the laser diode. |
| RS-232 | 11 | RXD | RS-232 receive | |
| | 12 | TXD | RS-232 transmit | |
| | 13 | CTS | Not used | |
| | 14 | RTS | Not used | |
| Ethernet EtherNet/IP | 16 | TX+ | Ethernet / EtherNet/IP communications | |
| | 17 | TX- | | |
| | 18 | RX+ | | |
| | 19 | RX- | | |
| PROFIBUS | 7 | PROFI A | A | |
| | 8 | PROFI B | B | |
| | 9 | VBUS | +5V | |
| | 10 | GNDBUS | GND | |
| Pulse outputs | 43 | POUT +V | Pulse output external power supply | If no external power supply is connected, then the pulse outputs default to the internal +5V supply. |
| | 37 | P1 | Pulse output 1 | RS-422 compliant differential pair outputs. |
| | 38 | P2 | Pulse output 2 | |
| | 39 | P3 | Pulse output 3 | |
| | 40 | P4 | Pulse output 4 | |
| | 41 | P5 | Pulse output 5 | |
| | 42 | P6 | Pulse output 6 | |
| Power supply and ground reference | 1 | +24V | Power supply | Operating voltage: 15 to 28VDC Power consumption: 15W |
| | 2 | | | |
| | 3 | DGND | Power supply and signal ground reference | |
| | 4 | DGND | | |
| | 15 | DGND | | |
| | 28 | DGND | | |
| | 34 | DGND | | |
| | 44 | DGND | | |
| Shield | S | Shield | Shield | Connect to cable and plug shields |

INPUT PARAMETERS

1 DW word = 2 bytes

DW word = 2 bytes

| DW | Bit | Comments | Unit | Range/Remark | Default value |
|------|-----|---------------------------------------|--|--|---------------|
| DW0 | | Reset | | | |
| | 0 | Total length reset | | | |
| | 1 | Batch length reset | | | |
| | 2 | Reel number reset | | | |
| DW1 | | Laser switch | | 0=OFF;1=ON | 1 |
| DW2 | | Preset length 1 / Preset batch length | 1=0.0001m{ft}{yds} 1=0.1m{ft}{yds} | 0~2 ³¹ | 1000000 0 |
| DW3 | | | | | |
| DW4 | | Preset length 2 / Preset batch number | 1=0.0001m{ft}{yds} 1=0.1m{ft}{yds} 1=1(batch number) | 0~2 ³¹ | 2000000 0 |
| DW5 | | | | | |
| DW6 | | Rate of pulse output 1 | 1=0.001p/m{ft}{yds} 1=0.0001m{ft}{yds}/p | 0~2 ³¹ | 1000 |
| DW7 | | | | | |
| DW8 | | Rate of pulse output 2 | | 0~2 ³¹ | 1000 |
| DW9 | | | | | |
| DW10 | | Rate of pulse output 3 | | 0~2 ³¹ | 1000 |
| DW11 | | | | | |
| DW12 | | Rate of pulse output 4 | | 0~2 ³¹ | 1000 |
| DW13 | | | | | |
| DW14 | | Rate of pulse output 5 | | 0~2 ³¹ | 1000 |
| DW15 | | | | | |
| DW16 | | Rate of pulse output 6 | | 0~2 ³¹ | 1000 |
| DW17 | | | | | |
| DW18 | | Pulse output mode | | | |
| | 0~2 | Puulse output group A mode | | 0=Single end(P1) (P2); 1=Differential(P1=/P2); 2=Quadrature(P1=Quad P2); 3=Differential Quadrature(P1/2=Quad P3/4) | 0 |
| | 3~5 | Puulse output group B mode | | 0=Single end(P3)(P4); 1=Differential(P3=/P4); 2=Quadrature(P3=Quad P4); | 0 |
| | 6~8 | Puulse output group C mode | | 0=Single end(P5)(P6); 1=Differential(P5=/P6); 2=Quadrature(P5=Quad P6); | 0 |
| | 9 | Pulse ouptut 1 rate mode | | 0=pulse/m{ft}{yds};1=m{ft}{yds}/ pulse | 0 |
| | 10 | Pulse ouptut 2 rate mode | | | 0 |
| | 11 | Pulse ouptut 3 rate mode | | | 0 |
| | 12 | Pulse ouptut 4 rate mode | | | 0 |
| | 13 | Pulse ouptut 5 rate mode | | | 0 |
| | 14 | Pulse ouptut 6 rate mode | | | 0 |

| DW | Bit | Comments | Unit | Range/Remark | Default value | | |
|------|-----|--|---------------------|---|---------------|---|--|
| | 15 | | | | | | |
| DW19 | | Logic input | | | | | |
| | 0 | LIN1 function | | 0=Direction (count down); 1=Length hold; 2=Display hold; 3=Speed hold; 4=Total length reset; 5=Batch length reset/End of reel; 6=None | 4 | | |
| | 1 | | | | 1 | | |
| | 2 | | | | | | |
| | 3 | LIN2 function | | | | | |
| | 4 | | | | | | |
| | 5 | | | | | | |
| | 6 | LIN3 function | | | 2 | | |
| | 7 | | | | 0 | | |
| | 8 | | | | | | |
| | 9 | LIN1 polarity | | 0=Active low; 1=Active high | | | |
| | 10 | LIN2 polarity | | | | | |
| | 11 | LIN3 polarity | | | | | |
| | 12 | Speed direction (available only when no logic input for direction) | | 0=Up/Normal; 1=Down/Invert | 0 | | |
| DW20 | | Logic output function | | | | | |
| | 0 | LOP 1 function | | 0=Gauge OK; 1=Gauge measuring speed; 2=Preset length1 / Batch length; 3=Preset length 2 / Batch number; 4=Good reading; 5=Object detected 6=Gauge too hot; 13=User 1;14=User 2;15=User 3 | 0 | | |
| | 1 | | | | 2 | | |
| | 2 | | | | | | |
| | 3 | LOP 2 function | | | | | |
| | 4 | | | | | 3 | |
| | 5 | | | | | | |
| | 6 | LOP 3 function | | | | | |
| | 7 | | | | | 0 | |
| | 8 | | | | | | |
| | 9 | LOP 3 function | | | | | |
| | 10 | | | | | | |
| | 11 | | | | | | |
| | 12 | | | | | | |
| | 13 | User I/P 1 | | 0=OPEN;1=CLOSE | 0 | | |
| | 14 | User I/P 2 | | 0=OPEN;1=CLOSE | | | |
| | 15 | User I/P 3 | | 0=OPEN;1=CLOSE | | | |
| DW21 | | Full scale for analogue O/P | 1=1m/min{ft/min} | 0~65535 | 1000 | | |
| DW22 | | Minimum speed limit | 1=0.01m/min{ft/min} | 0~65535 | 0 | | |
| DW23 | | | | | | | |
| DW24 | | Length offset | 1=0.0001m{ft}{yds} | $-2^{31} \sim +(2^{31}-1)$ | 0 | | |
| DW25 | | | | | | | |
| DW26 | | Averaging time | 1=1ms | 1~5000 | 1000 | | |
| DW27 | | Hold time after speed drop out | 1=1ms | 1~5000 | 100 | | |
| DW28 | | Reserved | | | | | |
| DW29 | | Good reading threshold for logic output | 1=1% | | 60% | | |

| DW | Bit | Comments | Unit | Range/Remark | Default value |
|------|----------------------------|---|-------------------------|---|---------------|
| DW30 | | Measurement Unit | | 0=m/min,m;1=ft/min,ft;2=ft/min,yds;3=ft/min,inch;4=yds/min,yds | 0 |
| DW31 | | | | | |
| DW32 | System settings | | | | |
| | 0 | Measurement mode | | 0=Normal;1=Batch | 0 |
| | 1 | Resolution of length output | | 0=length 0.0001;1=length 0.1 | 0 |
| | 2 | Speed reponse for pulse and analogue output | | 0=Averaged;1=Instant | 0 |
| | 3 | Analogue output source | | 0=Speed;1=Good Reading | 0 |
| | 4 | Hold length reading after power off(length auto save) | | 0=OFF;1=ON | 0 |
| | 5 | Object detection SW | | 0=OFF;1=ON | 0 |
| | 6 | Automatic reset length after object detected | | 0=OFF;1=ON | 0 |
| | 7 | | | | |
| | 8 | Object detection mode | available only on SL(R) | 0=DC Level;1=Zero Speed | 0 |
| | 9 | Pulse reset syn to length reset | | 0=OFF;1=ON | 0 |
| | 10 | Length reset trigger | | 0=Level;1=edge | 0 |
| | 11 | | | | |
| | 12 | | | | |
| DW33 | | Pulse width in m{ft}{yds}/pulse mode | 1=1ms | 0~5000(0=fixd to 50% duty cycle) | 0 |
| DW34 | | Object detection threshold | 1=1% | 0~100 | 15 |
| DW35 | | | | | |
| DW36 | | Preset case tempeprature for water solenoid control | 1=0.1℃ | 0~1000 | 650 |
| DW37 | | SLX-HA Height | 1=1mm(1=0.01inch) | -200mm~+200mm | 0 |
| DW38 | Logic input second fuction | | | | |
| | 0 | | | 0=Direction (count down); 1=Length hold; 2=Display hold; 3=Speed hold; 4=Total length reset; 5=Batch length reset/End of reel; 6=None | 6 |
| | 1 | LIN1 function 2 | | | |
| | 2 | | | | |
| | 3 | LIN2 function 2 | | | 6 |
| | 4 | | | | |
| | 5 | | | | 6 |
| | 6 | LIN3 function 2 | | | |
| | 7 | | | | |
| | 8 | | | | |
| | 9 | LIN1 function 2 polarity | | 0=Active low; 1=Active high | 0 |
| | 10 | LIN2 function 2 polarity | | | |
| | 11 | LIN3 function 2 polarity | | | |
| | 12 | | | | |
| DW39 | | | | | |
| DW40 | | | | | |
| DW41 | | | | | |
| DW42 | | | | | |
| DW43 | | | | | |
| DW44 | | | | | |

| DW | Bit | Comments | Unit | Range/Remark | Default value |
|------|-----|--|----------------|---|-------------------------|
| DW45 | | Modbus ID | 1=1 | 0~255 | 1 |
| DW46 | | Profibus ID | 1=1 | 0~125 | 7 |
| DW47 | | CANBUS address | 1=1 | 0~255 | 14 |
| DW48 | | CANBUS baud rate | | 0=250;1=500;2=1000;other=500 | 0 |
| DW49 | | CAN terminator | 1=1 | 0=OFF;1=ON | 1 |
| DW50 | | RS232 baud rate | | 0=4800;1=9600;2=19200;3=38400;4=115200 | 4 |
| DW51 | | RS232 protocol | | 0=Modbus;1=Proton;2=ZM400 Printer | 0 |
| DW52 | | RS422/RS485 protocol | | 0=Modbus;1=Proton | 0 |
| DW53 | | RS422/RS485 baud rate | | 0=4800;1=9600;2=19200;3=38400;4=115200;5=230400;6=460800;7=921600 | 4 |
| DW54 | | | | | |
| DW55 | | Ethernet protocol | | not used | 0 |
| DW56 | | ETH DHCP | | 0=Disabled;1=Enabled | 0 |
| DW57 | | iBus DHCP | | 0=Disabled;1=Enabled | 0 |
| DW58 | | ETH IP address | xx.xx.xx.xx | | C0A8016E(192.168.1.110) |
| DW59 | | | | | |
| DW60 | | ETH subnet mask | xx.xx.xx.xx | | FFFFFF00(255.255.0) |
| DW61 | | | | | |
| DW62 | | ETH gateway | xx.xx.xx.xx | | C0A80101(192.168.1.1) |
| DW63 | | | | | |
| DW64 | | iBus IP address | xx.xx.xx.xx | | C0A8016F(192.168.1.111) |
| DW65 | | | | | |
| DW66 | | iBus subnet mask | xx.xx.xx.xx | | FFFFFF00(255.255.0) |
| DW67 | | | | | |
| DW68 | | iBus gateway | xx.xx.xx.xx | | C0A80101(192.168.1.1) |
| DW69 | | | | | |
| DW70 | | Destination IP address for UDP (last section only) | | Port number fixed to 1111 | 2 |
| DW71 | | Interval time of UDP data output | 1=1ms | 0~5000(0=disable UDP output) | 0 |
| DW72 | | DeviceNet address | | 0~63 | 7 |
| DW73 | | DeviceNet baud rate | | 0=125K;1=250K;2=500K | 0 |
| DW74 | | Little Endian/Big Endian | | 1=Little Endian;0=Big Endian | 1 |
| DW75 | | | | | |
| DW76 | | Gain of analogue O/P | 1=0.0001 | 0~65535 | 10000 |
| DW77 | | Zero of analogue O/P | 1=0.0001 | -32768~32767 | 0 |
| DW78 | | Speed simulation | | 0=Normal;1=Simulation mode | 0 |
| DW79 | | Simulation speed | 1=0.1m{ft}/min | 0~6553.5 | 500 |
| DW80 | | Speed compensation coefficient | 1=0.0001 | | 10000 |
| DW81 | | Acceleration limit | 1=1m{ft}/min/s | 1~9999 | 9999 |
| DW82 | | Default parameters to factory | | 63000=default to factory;other=invalid | |

OUTPUT PARAMETERS

1 DW word = 2 bytes

DW word = 2 bytes

| DW | Bit | Comments | Units | Range/Remark |
|------|-----|---|--------------------------|-------------------------------|
| DW0 | 0 | Measurement mode | | 0=Normal;1=Batch |
| | 1 | Resolution of length output | | 0=length 0.0001;1=length 0.1 |
| | 2 | Speed reponse for pulse and analogue output | | 0=Instant;1=Averaged |
| | 3 | | | |
| | 4 | | | |
| | 5 | | | |
| | 6 | | | |
| | 7 | | | |
| | 8 | Measured length > Preset1 | | 1=>Preset |
| | 9 | Measured length > Preset2 | | 1=>Preset |
| | 10 | | | |
| | 11 | Laser Status | | 1= ON;0=OFF |
| | 12 | Speed reading valid | | 1=Valid;0=Invalid |
| | 13 | Object detected | | 1=Object detected;0=No object |
| | 14 | Good reading status | | 1=Lower than threshold;0=OK |
| | 15 | | | |
| DW1 | 0 | Gauge OK | | 1=OK;0=Failed |
| | 1 | Laser temperature too high | | 1=Too high;0=OK |
| | 2 | Laser temperature too low | | 1=Too low;0=OK |
| | 3 | Case temperature too high | | 1=Too high;0=OK |
| | 4 | Case temperature too low | | 1=Too low;0=OK |
| | 5 | Light reflection too strong | | 1=Too high;0=OK |
| | 6 | Gauge too hot | | 1=Too hot;0=OK |
| | 7 | | | |
| | 8 | | | |
| | | | | |
| DW2 | | Averaged speed | 1=0.001m/min{ft/min} | 0~±2 ³¹ |
| DW3 | | | | |
| DW4 | | Instant speed | | |
| DW5 | | | | |
| DW6 | | Total length | 1=0.0001/1=0.1m{ft}{yds} | 0~±2 ³¹ |
| DW7 | | | | |
| DW8 | | Batch length | | |
| DW9 | | | | |
| DW10 | | Last length before reset | | 0~2 ³¹ |
| DW11 | | | | |
| DW12 | | Reel number | 1=1 | 0~2 ³² |
| DW13 | | | | |
| DW14 | | Batch number | 1=1 | 0~65535 |
| DW15 | | Good reading | 1=1% | 0~100 |

| DW | Bit | Comments | Units | Range/Remark |
|------|-----|---------------------------|-------------------|--|
| DW16 | | SNR | 1=1 | 0~65535 |
| DW17 | | SLX current height | 1=1mm{1=0.01inch} | ±200mm |
| DW18 | | | | |
| DW19 | | | | |
| DW20 | | Logic input | | |
| | 0 | LIN1 status | | 1=Active |
| | 1 | LIN2 status | | 1=Active |
| | 2 | LIN3 status | | 1=Active |
| | 3 | | | |
| | 4 | Length reset | | 1=Active |
| | 5 | Length hold | | 1=Active |
| | 6 | Display hold | | 1=Active |
| | 7 | Speed hold | | 1=Active |
| | 8 | | | |
| | 9 | | | |
| | 10 | Length counting direction | | 0=counting up;1=counting down |
| DW21 | | | | |
| DW22 | | Measurement Unit | | 0=m/min,m;1=ft/min,ft;2=ft/min,yds;3=ft/min,inch; 4=yds/min,yds |
| DW23 | | | | |
| DW24 | | | | |
| DW25 | | | | |
| DW26 | | | | |
| DW27 | | | | |
| DW28 | | | | |
| DW29 | | | | |
| DW30 | | Communication Bus Type | | 0=NONE;1=PROFIBUS;2=PROFINET;3=Ethernet/IP; |
| DW31 | | Not used | | |
| DW32 | | IP address for ETH | xx.xx.xx.xx | |
| DW33 | | | | |
| DW34 | | IP address for iBUS | xx.xx.xx.xx | |
| DW35 | | | | |
| DW36 | | Sub net Mask for ETH | xx.xx.xx.xx | |
| DW37 | | | | |
| DW38 | | Gateway for ETH | | |
| DW39 | | | | |

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