Last Modified: 24 May 2023

Technical Instruction – **Cable Length Extension**

Scope

This technical bulletin provides guidance for increasing standard IMT sensor cable lengths.

Extension Considerations

Care must be taken to preserve signal integrity when extending IMT sensor cable lengths. The sensor cable supplied by IMT is a premium quality, exterior grade cable designed to last the lifetime of the sensor. Should cable extensions be required, the cable used must be of the same quality and similarly rated for environmentally appropriate harsh conditions, such as exposure to sunlight and high moisture environments. Installation technicians must ensure that all cable extensions utilize high quality cable that will either be enclosed (by conduit or other methods) or rated for exterior use under extreme environmental conditions – UV rated, weather and moisture resistant, etc.

Always use premium quality, gauge appropriate shielded copper cables (as determined by the charts in this document) from a reputable cable vendor to minimize interference. For RS485 sensors, ensure that the cables are twisted pair.

Cable shielding must be properly terminated as part of the installation. Ensure that the shield between the sensor cable and extension cable is connected and that the cable shield is properly terminated to ground. Only ground the shield at one end of the cable to avoid ground loops.

Below is a short list of key properties in determining appropriate cables:

1. Wire gauge should be a minimum of 26 AWG / 0.14 mm² copper. Refer to the tables provided later in this document for specific wire gauge to length recommendations.
2. When determining operating temperature range and outer jacket material, consider the environment where the sensor will be installed (UV resistance, etc).

Note: The sensor cable supplied by IMT is **not** suitable for direct bury or underground installation, even if installed within conduit.

Depending on environmental conditions, different cables may need to be used for different installations. There are three common installation scenarios where special considerations must be taken when selecting cables:

1. Unprotected outdoor installations (must account for UV, rain, ice, temperature range, etc.).
2. Direct bury (underground) application (must account for permanent humidity).
   Note: We do not recommend the use of non-direct bury cable for underground installations, even when installed in conduit as the conduit will fill with water overtime, resulting in moisture issues.
3. At farms on the roof of livestock enclosures (must account for ammonia).

Cable Length Charts

Below is a list of cable length charts that provide recommended extension lengths. These charts can also be found in the quick reference guides for the product in question, both on our website (https://www.imt-solar.com/downloads/) and in paper form shipped with the sensor.

Digital Sensors

Maximum additional cable length of RS485 Modbus IMT sensors (Si-RS485TC-XXX, Tm-RS485-MB, and Ta-ext-RS485-MB), dependent on power supply voltage:

Cable Cross Section	0.14 mm^2	0.25 mm^2	0.34 mm^2	0.5 mm^2	0.75 mm^2	1.0 mm^2	1.5 mm^2
24VDC Length	300m	600m	800m	1000m	1000m	1000m	1000m
12VDC Length	50m	100m	150m	200m	300m	400m	650m

Analog Sensors

Maximum additional cable length of analog IMT sensors:

Sensor Type	**Cable Cross Section**						
	0.14 mm^2	0.25 mm^2	0.34 mm^2	0.5 mm^2	0.75 mm^2	1.0 mm^2	1.5 mm^2
Si-mV-85	20m	20m	20m	20m	20m	20m	20m
Si-mV-85-Pt100-4L	20m	20m	20m	20m	20m	20m	20m
Si-mV-85-Pt1000	5m	10m	10m	15m	20m	20m	20m
Si-mV-85-Pt1000-4L	20m	20m	20m	20m	20m	20m	20m
Si-V-1.5TC	50m	50m	50m	50m	50m	50m	50m
Si-V-1.5TC-T	15m	30m	40m	50m	50m	50m	50m
Si-V-10TC	100m	100m	100m	100m	100m	100m	100m
Si-V-10TC-T	50m	100m	100m	100m	100m	100m	100m
Tm-V-4090	30m	50m	70m	100m	100m	100m	100m
Ta-V-4090	30m	50m	70m	100m	100m	100m	100m
Si-I-420TC	200m	200m	200m	200m	200m	200m	200m
Si-I-420TC-T	150m	200m	200m	200m	200m	200m	200m
Tm-I-4090	200m	200m	200m	200m	200m	200m	200m
Ta-I-4090	200m	200m	200m	200m	200m	200m	200m

For 4 wire RTDs such as the Ta-Pt100, Ta-Pt1000, and Tmodul, the maximum cable length is determined by the specifications of the data logger.

Note: IMT Solar does not recommend extending cable lengths of the Si-mV-85-Pt100, Vwind-IMP, or Tm-Pt1000 due to increased susceptibility to additional resistance.

Connectors

The sensor installer is responsible for choosing a suitable connection solution for cable extension. The solutions below may not be appropriate for all extension cable types and installation environments. The products shown are only examples that may be suitable for a particular application. In general, spring terminal connectors, butt connectors, terminal blocks or any other appropriate, low resistance gauge connector can be used for connecting wires. We do not recommend the use of twist-on wire nuts. Installations shall only be done by qualified technicians.

Always ensure that the color code for the sensor cable wires properly correlates to the color code of the extension cable wires (i.e., connect the +V wire to the +V wire, the -V wire to the -V wire). Remember the colors may not always match. Connecting the supply voltage to the signal lines for example, may damage the device in a way not covered under warranty.

Example 1: Plug Connectors

For cable extensions, always use plug connectors that are suitable for long-term, outdoor use and have a minimum IP66 protection rating. The plug connector must also connect the cable shields. The following are examples of suitable products that can be used.

Connector for Sensor

Vendor: Phoenix Contact, type: SACC-M12MSD-4PL SH PN, article number: 1424682
https://www.phoenixcontact.com/en-us/products/circular-connector-cable-side-sacc-m12msd-4pl-sh-pn-1424682

Connector for Extension Cable

Vendor: Phoenix Contact, type: SACC-M12FSD-4PL SH PN, article number: 1424683
https://www.phoenixcontact.com/en-us/products/circular-connector-cable-side-sacc-m12fsd-4pl-sh-pn-1424683

Features of these connectors:

- Protection class IP67
- Temperature range -40°C to 85°C
- Easy to use push-lock spring connection for wire installation
- Cable shields connected by metal housing
- Rugged
- Fits many different cable types

Example 2: Junction Box with Splicing Connectors

A junction box with splicing connectors can also be used for cable extensions. The box must have a minimum IP66 protection rating, be suitable for long-term, outdoor use and utilize appropriate cable installation glands. The following are examples of suitable products.

Junction Box

Vendor: Spelsberg, type: TK PC 77-6-m, article number: 12740101
https://www.spelsberg.com/industrial-housing/with-/-without-metric-knockouts/12740101/

Features of these junction boxes:

- Protection class IP66, Protection type UL 4X, 12/12K
- Temperature range -35°C to 80°C
- Suitable for outdoor use
- Cover material: Polycarbonate, glass-fiber reinforced
- Metric pre-embossings

Splicing Connector

Vendor: Wago, article number: 221-412
https://www.wago.com/us/wire-splicing-connectors/compact-splicing-connector/p/221-412

Note: For daisy chain connections, use article number 221-413 (3 connections) instead.

Features of these splicing connectors:

- Ease of use – pull the lever up, insert a conductor and push the lever back down
- Easily terminate conductors from 24 to 12 AWG, Fine-stranded conductor 26 to 12 AWG
- Connect solid, stranded and fine-stranded conductors
- Time savings for installers
- Available as 2-, 3- and 5-wire connectors
- Temperature range up to 85 °C

Cable Gland

Vendor: Phoenix Contact, type: G-INS-M16-T68N-PNES-GY, article number: 1424475
https://www.phoenixcontact.com/en-us/products/full-screw-connection-g-ins-m16-t68n-pnes-gy-1424475

Cable Gland Nut

Vendor: Phoenix Contact, type: A-INL-M16-P-LG, article number: 1417660
https://www.phoenixcontact.com/en-us/products/flat-nut-a-inl-m16-p-lg-1417660

Features of this cable gland:

- Protection class IP66, IP68 (5 bar / 0.5 h)
- Temperature range -40 °C to 100 °C (static)

- Cable gland material: PA
- External cable diameter 4 mm to 8 mm

Example 3: Butt Connector with Heat Shrink Tube

It is also possible to extend the sensor cable with a butt connector and a heat shrink tube over it. Ensure that the butt connector's cross section fits both sensor and extended cable and that the junction is sealed waterproof by heat shrink tube with glue from cable jacket to cable jacket. The outer heat shrink tube must be suitable for long-term, outdoor use.
Note: This option does not allow inspection of the junction and it is difficult to ensure that the junction is properly sealed.

Support
For additional information please contact IMT Solar at (716) 276-8466, info@imtsolar.com, or visit us at www.imtsolar.com.