

ITR

USER MANUAL



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Safety Symbols

The Safety symbols used on this product are:



HAZARDOUS VOLTAGE

Contact will cause electric shock or burn.



CAUTION

Used to alert for important information.



PROTECTIVE EARTHING TERMINAL

Protective Earthing Conductor $\geq 0.75\text{mm}^2$ shall be connected to GND terminal to protect against electric shock hazard.



READ INSTRUCTION MANUAL

Read the Instruction manual before installing or servicing this product.

Document Conventions

The Symbols used in this document are:



Is used to highlight additional information.



Is used to highlight any safety or regulatory points.

Safety Warnings

RESTRICTED ACCESS LOCATION



The ITR should be installed in a Restricted Access location, accessible only using a lock and key or other means of security.

INSTALLATION ENCLOSURE



The ITR should be installed on a DIN rail in an enclosure which acts as a Fire Enclosure and an Electrical Enclosure.

INSTALLATION PRACTICE



The ITR should be installed by a suitably qualified personnel.
Wiring, cable entries, conduit entries, knock-outs or glands should be installed in accordance with local wiring regulations.

HAZARDOUS VOLTAGE. Disconnect before working on product



DC supply voltage up to 300V.

DUAL SUPPLY. Disconnect both supplies before working on the product



Hazardous voltage may be present on DC supply and **PR-**, **HV-SW-**, **HV-SW+** and **PR+** terminals.

DISCONNECT DEVICE(S)



Each Hazardous Voltage circuit which connects to the ITR shall incorporate a readily accessible disconnect device installed externally to the ITR.
Disconnect devices shall have contact separation of at least 3mm.

HAZARDOUS VOLTAGE. Stray conductors or loose connections.



Provide insulation and strain relief on all Hazardous Voltage terminations to protect against electric shock hazard.

OVERCURRENT PROTECTION – HV MOSFET



Circuit from an external supply to HV MOSFET connections on the ITR shall be protected with an external 300 Vdc fuse rated at less than or equal to 200mA.

OVERCURRENT PROTECTION - POWER



Circuit from an external supply to the PWR connections on the ITR shall be protected with 300 Vdc an external fuse rated at less than or equal to 1A.

PROTECTIVE EARTH



The unit must be safety earthed whenever it is powered on, using the GND terminal as pictured above. The cable cross section must be equal to or greater than 0.75 mm² (18 AWG).

Introduction

The Isolated Timing Repeater (ITR) is a compact DIN rail mountable signal repeater providing 2.0kV electrical isolation between the power and I/O wiring and 3.5kV electrical isolation between input and earth for connected Intelligent Electronic Devices (IEDs).

The ITR performs several tasks including converting time sync signals from fiber to copper, (and vice versa), boosting signal strengths and converting one type of signal to another.

The ITR is available in multiple variants: -

Copper Input (Order Code D1)



- Takes a copper-based pulse or IRIG-B signal as input.
- Provides a non-isolated loop output of the input signal.
- Provides isolated TTL, RS232 and RS422 as standard outputs
- Provides isolated AM IRIG-B as an optional output.

Fiber Input (Order Code D2)



- Takes a copper or Fiber based pulse or IRIG-B signal as input.
- Provides isolated Fiber, TTL, RS232 and RS422 as standard outputs
- Provides isolated AM IRIG-B as an optional output.

HV MOSFET (Order code D3)



- Takes a Copper or Fiber based pulse or IRIG-B signal as input.
- Provides isolated Fiber and HV MOSFET output as standard.

For the HV MOSFET wiring use a slow blow fuse with a 300V dc voltage rating, and no greater than a 200mA current rating.

Note: For the HV MOSFET ITR option, high voltage may be present on the HV terminals as well as the PWR input terminals. For this reason, there is a DUAL SUPPLY label affixed to warn of this as pictured above.

All three configurations can be ordered with a low, medium or high voltage power supply option with typical power drain of 5W max. The power to I/O isolation is 2kV.

For further reading you can refer to the following documents on the Tekron website
www.tekron.com

- ITR Datasheet <https://tekron.com/dmsdocument/109>
- Typical Installation Guide <https://tekron.com/dmsdocument/103>
- Declaration of Conformity <https://tekron.com/dmsdocument/260>
- RoHS Statement <https://tekron.com/dmsdocument/110>
- Order Code Guide <https://tekron.com/dmsdocument/108>

ITR Product Codes

The tables below summarize the ITR order options.

Copper

ITR Order Code Guide					Order Code	D1	-	X	X
	Description								
Product Type	ITR Signal Repeater (Copper Version)					D1			
	Description	Connector Type		Specification					
Power Supply Options	Low Voltage	2 pin screw terminal		14 - 36 Vdc (360 – 140 mA)				1	
	Medium Voltage	2 pin screw terminal		20 - 75 Vdc (250 – 80 mA)				2	
	High Voltage	2 pin screw terminal		90 - 300 Vdc (56 – 17 mA)				3	
	Description	Connector Type		Specification					
	TTL Output	2 pin screw terminal		0-5V, 150mA Fused					
	RS232 Output	2 pin screw terminal		±10V (Typical unloaded), 15mA (max)					
	RS422 Output	2 pin screw terminal		±5V, 50 RS422 Loads (RS485 Compatible)					
	Description	Connector Type	Signal Type	Specification					
Options	DC IRIG-B to AM IRIG-B Converter	2 pin screw terminal	AM IRIG-B	8V pk-pk, Internal impedance:120Ω					J
	No Secondary Output	N/A	N/A	N/A					K

Fiber

ITR Order Code Guide					Order Code	D2	-	X	X
	Description								
Product Type	ITR Signal Repeater (Fiber Version)					D2			
	Description	Connector Type		Specification					
Power Supply Options	Low Voltage	2 pin screw terminal		14 - 36 Vdc (360 – 140 mA)				1	
	Medium Voltage	2 pin screw terminal		20 - 75 Vdc (250 – 80 mA)				2	
	High Voltage	2 pin screw terminal		90 - 300 Vdc (56 – 17 mA)				3	
	Description	Connector Type		Specification					
Standard Outputs	Fiber	ST Fiber Connection		Multi-mode 50/125 μm, 62.5/125um, 100/140 μm, and 200 μm HCS cable supported, λ = 820 nm					
	TTL Output	2 pin screw terminal		0-5V, 150mA Fused					
	RS232 Output	2 pin screw terminal		±10V (Typical unloaded), 15mA (max)					
	RS422 Output	2 pin screw terminal		±5V, 50 RS422 Loads (RS485 Compatible)					
	Description	Connector Type	Signal Type	Specification					
Options	DC IRIG-B to AM IRIG-B Converter	2 pin screw terminal	AM IRIG-B	8V pk-pk, Internal impedance:120Ω					J
	No Secondary Output	N/A	N/A	N/A					K

HV MOSFET

ITR Order Code Guide				Order Code	D3	-	X
	Description						
Product Type	ITR Signal Repeater (HV MOSFET Version)				D3		
	Description		Connector Type	Specification			
Power Supply Options	Low Voltage		2 pin screw terminal	14 - 36 Vdc (360 – 140 mA)			1
	Medium Voltage		2 pin screw terminal	20 - 75 Vdc (250 – 80 mA)			2
	High Voltage		2 pin screw terminal	90 - 300 Vdc (56 – 17 mA)			3
	Description		Connector Type	Specification			
Output	Fiber		ST Fiber Connector	Multi-mode 50/125 μ m, 62.5/125 μ m, 100/140 μ m, and 200 μ m HCS cable supported, λ = 820 nm			
	HV MOSFET Output – Screw Terminals		2 pin screw terminal	300 Vdc (+0V tolerance), \leq 100mA			



If 300V is used for both the supply and the HV MOSFET, then the input voltage tolerance must match that of the HV MOSFET = 300V +0V tolerance.

LED Indicators

ITRs have two green LEDs: -

PWR: On solidly when the correct power is supplied to the ITR.

SIG: Lit when the input signal is at a logic high level. Normally this LED will flicker at a 100Hz rate when an IRIG-B signal is fed to the ITR.

ITR Inputs

Copper Inputs

All ITR types can take a TTL level signal fed into the **Input** terminals at the top right of the ITR. The polarity of this driving signal must match that on the ITR label.

Note: The copper input signal can be any TTL signal such as DLCS IRIG-B, or it can be pulsed at TTL Levels (for example Pulse per second). The current loading at 5V is 2mA maximum.

If the ITR is part of a daisy-chained string of devices, the **LOOP** terminals on the Copper ITR can be used to wire to the next device in the daisy-chain. For the other ITR types, both the incoming and outgoing IRIG-B signals can be wired to the same **Input** terminals.

If the ITR is the last device in the daisy-chain, then the **TERM** connections can be shorted which will terminate the incoming IRIG-B signal with 120Ω. This will correctly terminate a 120Ω balanced line recommended for signal distribution.

The input to earth isolation is 3.5kV minimum.

The ITR is designed with balanced inputs and outputs which allow the use of twisted pair cabling to distribute time synchronization signals and provide excellent noise immunity from induced voltages in a noisy substation environment.

Fiber Inputs

The Fiber ITR types can take both a TTL copper input as well as a Fiber input signal. These two signal sources are fed to a logic AND gate. The output of this AND gate is then used to generate the ITR's Fiber signal and the Isolated copper output signals.

If both the copper and fiber inputs are used, the output is therefore the logical AND of the two input signals. Usually only one input is used at a time, or the two inputs need to be identical for meaningful outputs.

The fiber connection is ST Fiber, $\lambda = 820 \text{ nm}$, and multi-mode. 50/125 μm , 62.5/125 μm , 100/140 μm , and 200 μm HCS cable is supported.

The receiver sensitivity is -24 dBm.

ITR Outputs

Typical input to Copper / Fiber output delays are $85 \pm 10 \text{ ns}$.

Copper Loop Output

The copper loop output from the ITR is wired in parallel with the ITR's copper input. It is therefore not electrically isolated from the copper input. Shorting the **Term** connection terminals will add a 120Ω resistor across the copper input effectively terminating the copper line.

Fiber Output

The Fiber output signal mirrors the input from either the copper input or Fiber input signal. If both are present at the same time, then the Fiber output signal will be the logic AND of the two signals.

The fiber output is $\lambda = 820 \text{ nm}$, and multimode. 50/125 μm , 62.5/125 μm , 100/140 μm , and 200 μm HCS cable is supported.

Assuming 62.5/125 μm cable is used, and another Tektron device is receiving the fiber signal, the optical power budget is: 10.4 dB typical, 5 dB worst case.

The output delivers -15dBm of power in the typical case, -19 dBm in the worst case.

TTL Output

The TTL Output is a 0 to 5V Pk signal capable of driving up to 150mA loading. This output is internally protected with a PTC self-resetting fuse.

RS422 /RS 485 Outputs

The RS422/RS485 output is $\pm 5\text{V}$, or 50 RS422 unit loads (RS485 Compatible).

RS 232 Output

The RS232 output is $\pm 10\text{V}$ (typical unloaded), and capable of driving 15mA maximum.

MOSFET Output

The HV MOSFET option provides a 300Vdc (+0V tolerance), 100mA, high speed MOSFET, fused with reverse polarity and ESD protection. The internal signal delay from input to HV MOSFET output is 60uS typically.

Optional AM IRIG-B Output

The Optional AM IRIG-B output provides an Amplitude modulated IRIG-B output signal nominally 8 V pk-pk with 120Ω output impedance.

General User Guideline

The ITR should only be maintained by suitably qualified personnel.

The safety considerations outlined in the following installation guideline should be followed and not compromised in any way. Fuses and protection devices should be replaced only with the same rated components. Protective earths should not be disconnected or removed.

The ITR does not generate any high voltages, but instead may have one or more high voltages fed to it as a power supply or for switching - as is the case for the HV MOSFET option. The operator should familiarise themselves with how to isolate all voltages fed to the ITR before working on it.

Once installed, the ITR requires no adjustments or setup. The unit has two LEDs that indicate the power supply is present and an input signal is present.

General Installation Guideline

Identification

Each ITR unit is shipped with an identification label on its side. This label provides details of the ITR product code, the power supply requirement and serial number.



Check the identification label on the side of the unit to ensure that the correct model has been supplied before proceeding with the installation!

Location

INSTALLATION ENCLOSURE



The ITR should be installed on a DIN rail in an enclosure which acts as a Fire Enclosure and an Electrical Enclosure.

RESTRICTED ACCESS LOCATION



The ITR should be installed in a Restricted Access location, accessible only using a lock and key or other means of security.

INSTALLATION PRACTICE



The ITR should be installed by suitably qualified personnel.

Wiring, cable entries, conduit entries, knock-outs or glands should be installed in accordance with local wiring regulations.

Power Supply



The input voltage range is marked on the product label on the side of the ITR. Do not apply voltage outside this range. Note that either supply polarity is acceptable due to internal rectification.

OVERCURRENT PROTECTION – HV MOSFET



Circuitry from an external supply to the HV MOSFET on the ITR shall be protected with a 300 Vdc fuse rated at $\leq 200\text{mA}$.

OVERCURRENT PROTECTION - POWER



For the power supply protection fuse: -

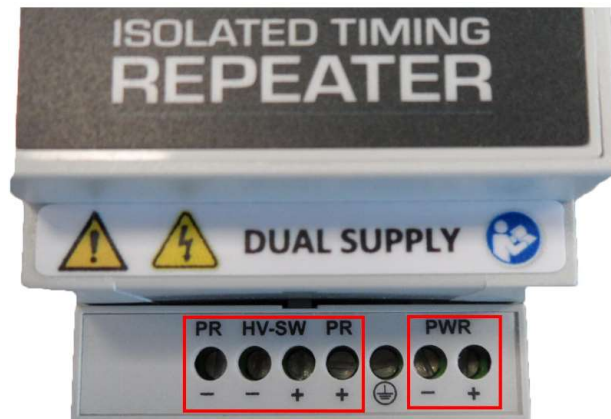
- Use a slow blow fuse
- Calculate the fuse current rating using the following formula: -

Fuse current rating = The lesser of 1A or $\frac{10}{\text{Supply Voltage}}$ Amps

Fuse voltage rating = At least the maximum supply voltage

For example, if using a 300V power supply, the rating should be $\frac{10}{300} = 33\text{mA}$, so a 40mA (or above current) slow blow fuse rated at or above 300V dc would be suitable.

Hazardous Voltage



HAZARDOUS VOLTAGE - Disconnect before working on product
DC supply voltage up to 300V, (+0V tolerance).



DUAL SUPPLY - Disconnect both supplies before working on the product
Hazardous voltage may be present on DC supply and **PR-**, **HV-SW-**, **HV-SW+** and **PR+** terminals.



DISCONNECT DEVICE(S)

Each Hazardous Voltage circuit which connects to the ITR shall incorporate a readily accessible disconnect device installed externally to the ITR.
Disconnect devices shall have contact separation of at least 3mm.

ITR Terminals





HAZARDOUS VOLTAGE. Stray conductors or loose connections.

Provide insulation and strain relief on all Hazardous Voltage terminations to protect against electric shock hazard.

The screw clamp terminals on the ITR accept 30 to 12 AWG solid or stranded cable (1.5mm Ø max). Please ensure that the wiring is terminated without exposing any bare copper wire.

Ensure all wiring to the ITR is done in a way so that if one screw termination becomes loose, then the wire will not be able to come in contact with other terminals. Each individual wire requires a secondary fixing method.

This can be achieved by securing all three power wires together, (+, - and GND), and similarly, for the wiring to the HV MOSFET option secure up to 4 wires as required.

An example of one way to achieve this is to terminate individual wires into crimp pin terminals (e.g. Multicomp MC29483), then heat shrink the crimped wires together so they support each other.



INSTALLATION ENCLOSURE



The ITR should be installed on a DIN rail in an enclosure which acts as a Fire Enclosure and an Electrical Enclosure.

INSTALLATION PRACTICE



The ITR should be installed by suitably qualified personnel.

Wiring, cable entries, conduit entries, knock-outs or glands should be installed in accordance with local wiring regulations.

Earthing



PROTECTIVE EARTH



The unit must be safety earthed using the GND terminal (as pictured above) whenever it is powered on. The cable cross section must be equal to or greater than 0.75 mm² (18 AWG).

Warranty

For terms and conditions of Tekron's Warranty see the Web Site <http://tekron.com/about-tekron/warranty>

Contact

The ITR is manufactured in New Zealand by Tekron International Limited.

To contact Tekron please visit <https://tekron.com/contact-us/>