

ESI-1553RPT

**MIL-STD-1553/1760
Bus Repeater**

User's Manual



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1 Introduction

The ESI-1553RPT repeater was developed for customers who need to extend the existing length of their bus or provide the capability to utilize long stubs or to connect a number of devices to a single stub. The repeater was implemented using simple signal detection and switching techniques to minimize the delay through the device. Delay through the unit is in the range of typically of 700 nsec. to 900 nsec. maximum.

Each connection to the bus is made through the implementation of a bus coupler in various configurations. Standard MIL-STD-1553 transceivers and digital signal processing are utilized to steer and shape the received signals, and retransmit them in the correct direction. Each of the two connections (J1 and J2) is bi-directional. Its type of connection is defined specifically in each configuration as marked on top of the box. A signal received at either connector will enable the signal to flow through towards the other connector.

P1 provides the power connection to the device which is 12-36 VDC (28V nominal). The unit is intended to operate within the temperature range of -40° to 85° C.

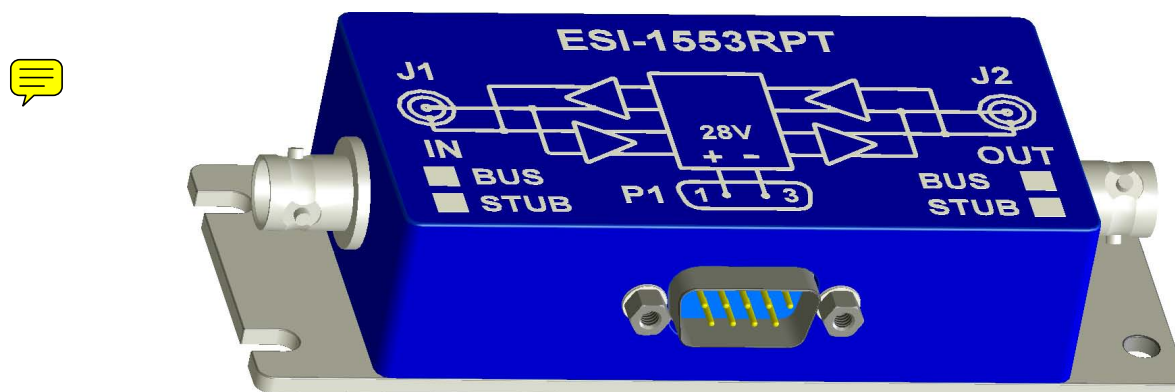


Figure 1 ESI-1553RPT Repeater – 3D View

1.1 Unidirectional Option (-002)

The ESI-1553RPT-xxxx-002 repeater implements one direction only, J1 to J2. The opposite path, J2 to J1, is blocked. This application can be used, for example, when the RT responses must be blocked from reaching the main MIL-STD-1553 bus.

1.2 Technical Support

Excalibur Systems is ready to assist you with any technical questions you may have. For technical support, see the Technical Support section of our website: www.mil-1553.com. You can also contact us by phone. To find the location nearest you, see the Contact Us section of our website.

2 General Characteristics

2.1 Response Time Consideration

As mentioned above the delay time through the unit is around 700 nsec typical, which causes the MIL-STD-1553 message Command to appear 700 nsec later on the repeated side. Now, when the 1553 devices responds with its Status word, it appears on the main bus with an additional delay of 700 nsec. So in total the response time of a device located after the ESI-1553RPT will be enlarged by 1.4 μ sec. approximately.

Note This enlargement has to be considered for devices with response times close to the system's upper limit before adding the repeater.

2.2 Output Reshaping and Symmetry

As a limitation of the 1553 Transceiver device, used within the ESI-1553RPT, the signal transmitted by the repeater has to be symmetrical in order to ensure that no DC offset is introduced onto the system bus. A symmetrical signal means that each bi-phase sync or data bit pattern must have an equal period of high & low or low & high times. Therefore the signals received from one side are reshaped before transmitting to the other side. The reshaping circuit reconstructs the signals in exact multiples of 0.5 μ sec. (i.e. 0.5 μ sec., 1 μ sec., 1.5 μ sec., 2 μ sec.).

In addition, a correcting circuit is included within the repeater, which corrects asymmetric patterns (Manchester errors) of the currently transmitted word. This correction is activated once an asymmetric quantity of 4 half bit times was detected. It may appear anywhere after the asymmetry started or at the end of the last word in a continuous string. The effect of this is that messages with Manchester errors will be retransmitted with Manchester errors but may somewhat change the bit pattern of the signal.

Another limitation of the 1553 Transceiver is that it requires waiting 1.3 μ sec from the end of a transmitted word before transmitting in the opposite direction. This waiting period should not interfere with standard MIL-STD-1553 operation, since according to the MIL-STD-1553 specification the minimum response time is 2 μ sec.

3 Mechanical and Electrical Specifications

3.1 Mechanical Outline of the ESI-1553RPT

All measurements have a tolerance of ± 0.1 mm (0.004").

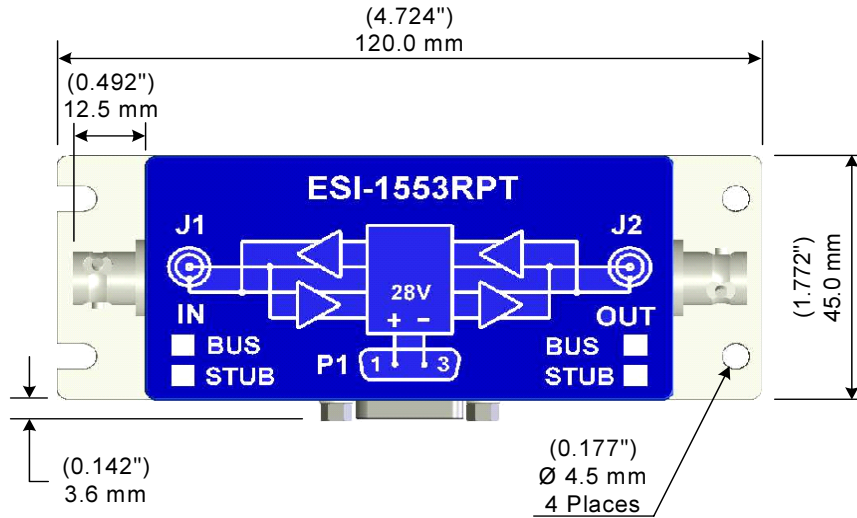


Figure 2 ESI-1553RPT – Top View

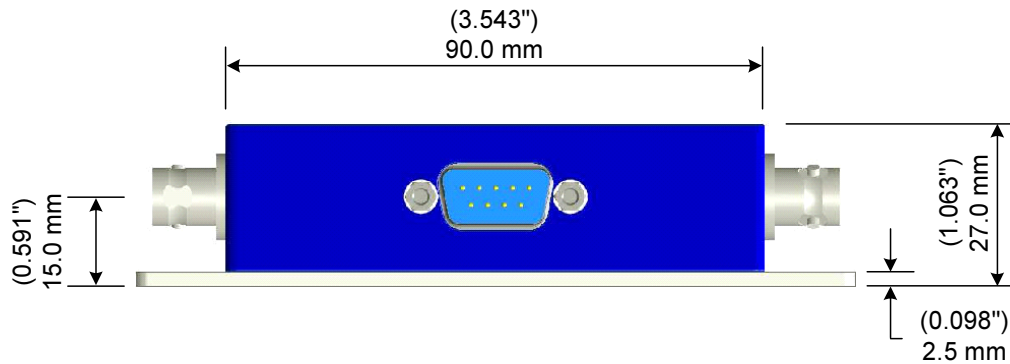


Figure 3 ESI-1553RPT – Side View

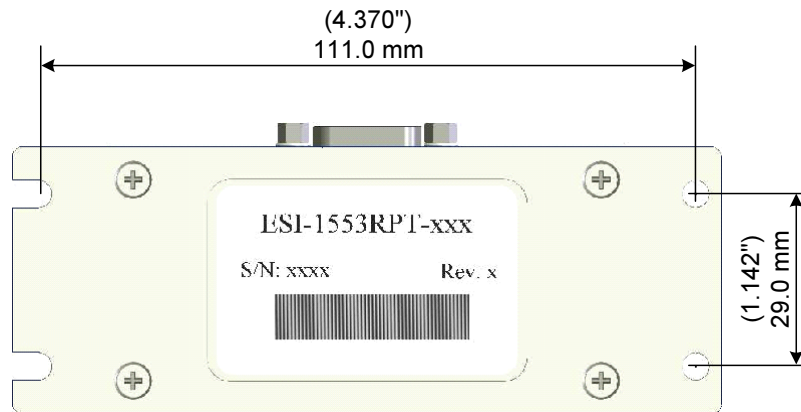


Figure 4 ESI-1553RPT – Bottom View

3.2 Connectors

BUS CONNECTORS [J1 AND J2]

The J1 and J2 connectors are Trompeter BJ77 or equivalent. The connector's pin assignments are:

Pin Name	Signal Name	Description
CENTER PIN	BUS_Hi	MIL-STD-1553 bus high connection
INNER SHEATH	BUS_Lo	MIL-STD-1553 bus low connection
BODY ASSEMBLY	SHIELD	Cable shield connection

Connectors J1 and J2 mate with a Trompeter PL75 connector or equivalent (not included).

POWER CONNECTOR [P1]

The P1 connector is DB9 male connector. The P/N is CONEC 163A11319X. The connector's pin assignments are:

Pin #	Signal Name	Description
1	PWR+	DC power source '+'
3	PWR-	DC power source '-'
5	SHIELD	Case connection

Connector P1 mates with a standard DB9 female connector. A DB9 female connector and a plastic hood are included.

3.3 Power Requirements

The power requirements for the repeater are:

- **Voltage:** 28VDC nominal (12–36VDC).
- **Power:** 4.0 Watts maximum at full loading and 100% duty cycle. In a typical application with 50% duty cycle, the power consumption is approximately 2.5 Watts.

3.4 Weight

The unit weighs 175 grams.

4 Repeater Application Options

The ESI-1553RPT can be used for any application where increased signal amplitude or wave shape reforming is required. There are four configurations available for the repeater:

- 4.1 ESI-1553RPT-BUS: Bus Repeater Application
- 4.2 ESI-1553RPT-STUB: Stub Repeater Application
- 4.3 ESI-1553RPT-SPLIT: Stub Splitter/Extender Application
- 4.4 ESI-1553RPT-S2S: Stub to Stub Repeater Application

The key to making either an existing, or modified bus architecture functionally operational, is to test the design thoroughly. This would also include a design that includes a repeater.

4.1 ESI-1553RPT-BUS: Bus Repeater Application

A bus repeater is needed if your design meets one or more of the following criteria:

- If there are many RTs on the bus and as a result the signal level is low.
- The bus is 100 meters long and needs to be extended.

The standard bus repeater application is used to extend the bus length up to an additional 100 meters (300 ft.) from the maximum specified in the standard. This application assumes the bus is cut and an additional bus section added. The remote terminals can either be existing or new equipment that are added or relocated.

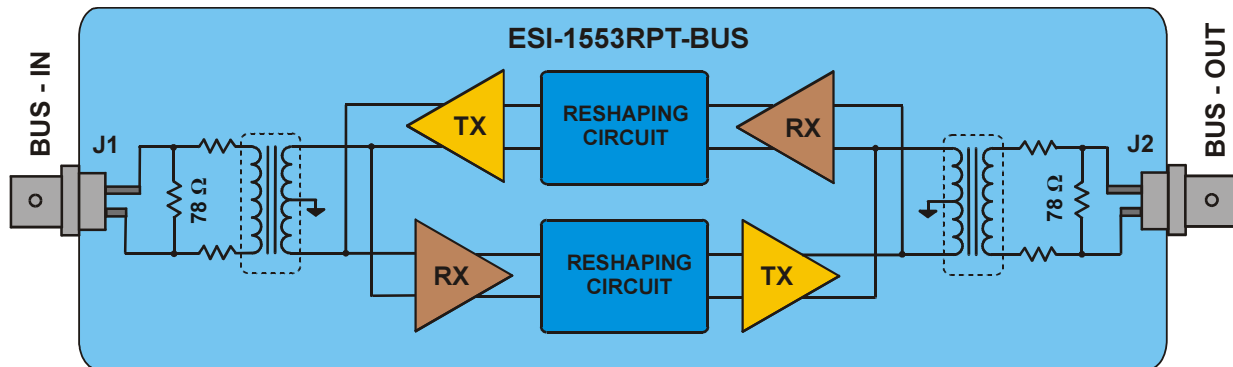


Figure 5 Bus Repeater (ESI-1553RPT-BUS) Block Diagram

CONNECTION INSTRUCTIONS

Connect	To	Comment
J1 (Trompeter BJ77 or equivalent)	End of existing bus	Termination resistor is already included within the repeater
J2 (Trompeter BJ77 or equivalent)	New bus extension	Termination resistor is already included within the repeater
Note	The new bus extension should be maximum 100 m. (300 ft.) in length and includes all the couplers required to connect the various 1553 devices with a termination resistor at the other end.	
P1 (DB9 male type)	DC power source of 28V nominal	For pinouts, see Power Connector [P1] on page 7

4.2 ESI-1553RPT-STUB: Stub Repeater Application

There are many factors that determine if a longer than specified stub will work. These include:

- How heavily the bus is loaded (total number of remote terminals).
- Proximity to the Bus Controller (the closer the stub is to the BC, the higher the probability of operating).
- Architecture of the bus (whether it was designed utilizing lumped or distributed couplers).

The Stub repeater is used where a stub length has to be excessively long due to routing or the need to locate it a considerable length from the bus connection. Although the specification states that the maximum length of a stub is 20 feet it is not necessarily assumed that by exceeding this length that all such connections require a stub repeater.

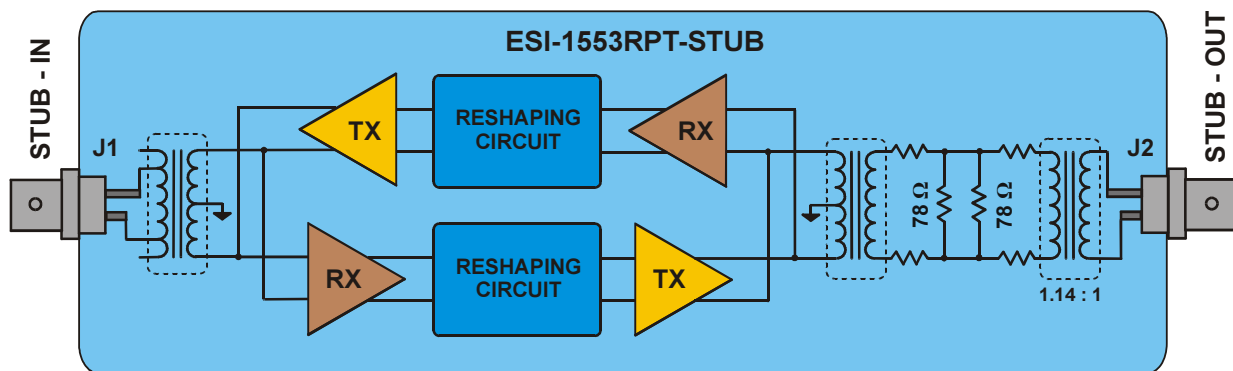


Figure 6 Stub Repeater (ESI-1553RPT-STUB) Block Diagram

CONNECTION INSTRUCTIONS

Connect	To	Comment
J1 (Trompeter BJ77 or equivalent)	Available stub output	With a 6m (20 ft.) maximum length cable
J2 (Trompeter BJ77 or equivalent)	1553 device	With a 6m (20 ft.) maximum length cable
P1 (DB9 male type)	DC power source of 28V nominal	For pinouts, see Power Connector [P1] on page 7

4.3 ESI-1553RPT-SPLIT: Stub Splitter/Extender Application

A Stub Splitter/Extender is needed in following cases:

- Two or more 1553 devices need to be connected to a single stub output.
- Where the 1553 stub needs to be extended up to 100 meters (300 ft.)
- Both

In this application the ESI-1553RPT is configured as stub connection at J1 and as Bus connection with termination at J2. This application involves additional components (i.e. bus coupler/s and termination resistor).

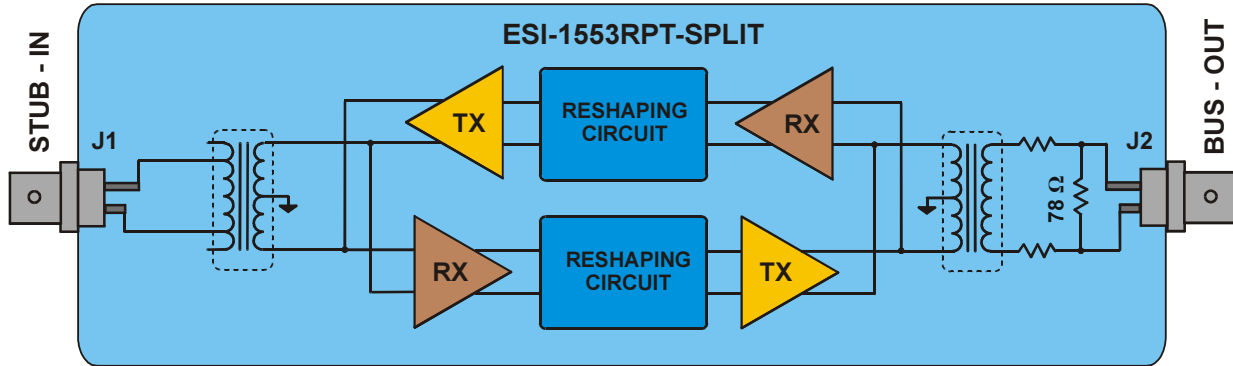


Figure 7 Stub Splitter/Extender (ESI-1553RPT-SPLIT) Block Diagram

CONNECTION INSTRUCTIONS

Connect	To	Comment
J1 (Trompeter BJ77 or equivalent)	Available stub output	With a 6m (20 ft.) maximum length cable
J2 (Trompeter BJ77 or equivalent)	A coupler's bus input	With a required cable length of up to 100 m. (300 ft.) max.
1553 device(s)	To the coupler's stub output(s)	With a 6m (20 ft.) maximum length cable
A terminator resistor	The coupler's second bus connection	Or use a coupler with an integrated termination
P1 (DB9 male type)	DC power source of 28V nominal	For pinouts, see Power Connector [P1] on page 7

4.4 ESI-1553RPT-S2S: Stub to Stub Repeater Application

A stub to stub repeater is needed in following cases:

- Two stub outputs need to be connected together.
- Bus A stub output needs to be connected temporarily to Bus B stub output for diagnostic tests.

In this application the ESI-1553RPT is configured as stub input both connections, J1 and J2.

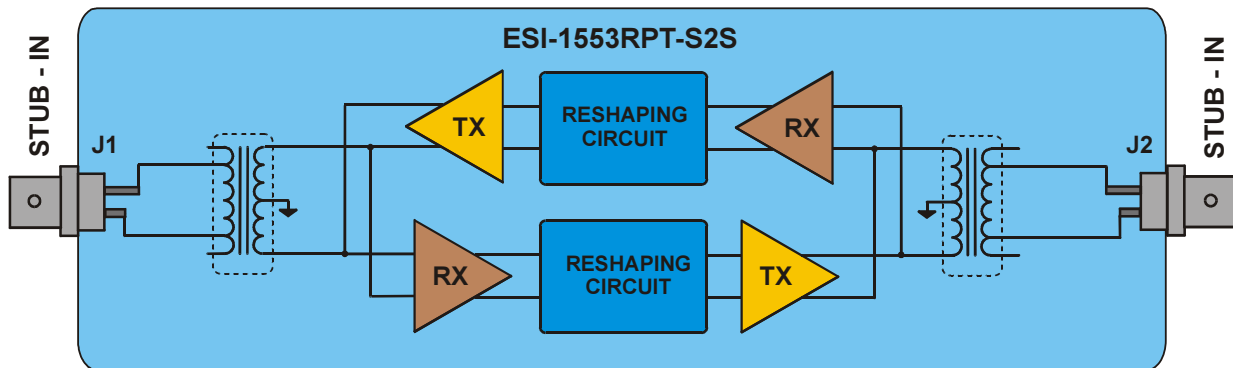


Figure 8 Stub to Stub Repeater (ESI-1553RPT-S2S) Block Diagram

CONNECTION INSTRUCTIONS

Connect	To	Comment
J1 (Trompeter BJ77 or equivalent)	Available stub output	With a 6m (20 ft.) maximum length cable
J2 (Trompeter BJ77 or equivalent)	A second available stub output	With a 6m (20 ft.) maximum length cable
P1 (DB9 male type)	DC power source of 28V nominal	For pinouts, see Power Connector [P1] on page 7

5 Ordering Information

Use the following part numbers when ordering the bus repeater:

Basic Part #	Option	Description
ESI-1553RPT-BUS		Single bus, bus repeater
ESI-1553RPT-STUB		Single bus, stub repeater
ESI-1553RPT-SPLIT		Single bus, stub splitter/extender
ESI-1553RPT-S2S		Single bus, stub to stub repeater
	-002	Same as above with unidirectional option, J1 to J2 only

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