

# Trusted Communications Cables

## Product Overview

This document provides detailed information for the types of Trusted® Communications Cables currently available. These are listed in Table 1 below.

Cable Type	Description
TC-301-02-xmx	Local Expansion Cable From Expander Interface Adapter (T8312) to Expander Processor (T8310)
TC-301-03-xmx	Local Expansion Cable (UL) From Expander Interface Adapter (T8312) to Expander Processor (T8310)
TC-302-02-xmx	Remote Expansion Cable From Expander Interface Adapter (T8312) to Fibre TX/RX unit (T8314)
TC-302-03-xmx	Remote Expansion Cable (UL) From Expander Interface Adapter (T8312) to Fibre TX/RX unit (T8314)
TC-303-02-xmx	Remote Expansion Cable From Fibre TX/RX unit (T8314) to Expander Processor (T8310)
TC-303-03-xmx	Remote Expansion Cable (UL) From Fibre TX/RX unit (T8314) to Expander Processor (T8310)
TC-304-01	Maintenance Cable
TC-305-01	Communications Cable Assembly From Communication Interface (T8151) to flying leads
TC-306-02	Input Smart Slot Jumper Cable
TC-306-03	Input Smart Slot Jumper Cable (UL)
TC-308-02	Output Smart Slot Jumper Cable
TC-308-03	Output Smart Slot Jumper Cable (UL)
TC-310-02	Output Smart Slot Jumper Cable from Digital Output Module (T8472)

Cable Type	Description
TC-310-03	Output Smart Slot Jumper Cable from Digital Output Module (T8472) (UL)
TC-311-02	Local Expansion Cable Assembly, 1 way From Expander Interface Module (T8311) to Triple Modular Redundant (TMR) Expander Processor (T8310)
TC-311-03	Local Expansion Cable Assembly, 1 way (UL) From Expander Interface Module (T8311) to Triple Modular Redundant (TMR) Expander Processor (T8310)
TC-312-02-xmx	Local Expansion Cable Assembly, 2 way From Expander Interface Module (T8311) to Triple Modular Redundant (TMR) Expander Processor (T8310)
TC-312-03-xmx	Local Expansion Cable Assembly, 2 way (UL) From Expander Interface Module (T8311) to Triple Modular Redundant (TMR) Expander Processor (T8310)
TC-313-02-xmx	Local Expansion Cable Assembly, 3 way From Expander Interface Module (T8311) to Triple Modular Redundant (TMR) Expander Processor (T8310)
TC-313-03-xmx	Local Expansion Cable Assembly, 3 way (UL) From Expander Interface Module (T8311) to Triple Modular Redundant (TMR) Expander Processor (T8310)
TC-314-02-xmx	Expander Electrical Extension Cable From Processor Interface Adapter (T8312) to TMR Expander Processor (T8310)
TC-314-03-xmx	Expander Electrical Extension Cable (UL) From Processor Interface Adapter (T8312) to TMR Expander Processor (T8310)

**Table 1 Trusted Communications Cables**

The -01 / -02 / -03 suffix of the cable part number dictates the properties of the cable:

- 01 suffix cables are PVC.
- 02 suffix cables are cables which are Halogen free, i.e. low smoke zero halogen, flame retardant to IEC 60332-3 Cat A.
- 03 suffix cables are UL Certified.

The cables are manufactured to standard integration requirements, only the type of cable insulation must be specified. For non-standard lengths, length must be specified to the nearest 0.5 m in the format xmx, e.g. 2m0 for a cable length of 2.0 m. This detail must be added to the end of the part number. The maintenance cables are supplied with PVC sheathed cables only. When ordering cables, it is recommended that the user supplies the details as shown in Table 1.



## PREFACE

In no event will Rockwell Automation be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment. The examples given in this manual are included solely for illustrative purposes. Because of the many variables and requirements related to any particular installation, Rockwell Automation does not assume responsibility or reliability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, with respect to use of information, circuits, equipment, or software described in this manual.

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All trademarks are acknowledged.

### DISCLAIMER

It is not intended that the information in this publication covers every possible detail about the construction, operation, or maintenance of a control system installation. You should also refer to your own local (or supplied) system safety manual, installation and operator/maintenance manuals.

### REVISION AND UPDATING POLICY

This document is based on information available at the time of its publication. The document contents are subject to change from time to time. The latest versions of the manuals are available at the Rockwell Automation Literature Library under "Product Information" information "Critical Process Control & Safety Systems".

### TRUSTED RELEASE

This technical manual was updated for **Trusted Release 4.0**.

### LATEST PRODUCT INFORMATION

For the latest information about this product review the Product Notifications and Technical Notes issued by technical support. Product Notifications and product support are available at the Rockwell Automation Support Centre at <http://rockwellautomation.custhelp.com>

At the Search Knowledgebase tab select the option "By Product" then scroll down and select the Trusted product.

Some of the Answer ID's in the Knowledge Base require a TechConnect<sup>SM</sup> Support Contract. For more information about TechConnect Support Contract Access Level and Features, click on the following link:

[https://rockwellautomation.custhelp.com/app/answers/detail/a\\_id/50871](https://rockwellautomation.custhelp.com/app/answers/detail/a_id/50871)

This will get you to the login page where you must enter your login details.

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**IMPORTANT** A login is required to access the link. If you do not have an account then you can create one using the "Sign Up" link at the top right of the web page.

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## DOCUMENTATION FEEDBACK

Your comments help us to write better user documentation. If you discover an error, or have a suggestion on how to make this publication better, send your comment to our technical support group at <http://rockwellautomation.custhelp.com>

## SCOPE

This manual specifies the maintenance requirements and describes the procedures to assist troubleshooting and maintenance of a Trusted system.

## WHO SHOULD USE THIS MANUAL

This manual is for plant maintenance personnel who are experienced in the operation and maintenance of electronic equipment and are trained to work with safety systems.

## SYMBOLS

In this manual we will use these notices to tell you about safety considerations.



**SHOCK HAZARD:** Identifies an electrical shock hazard. If a warning label is fitted, it can be on or inside the equipment.



**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which can cause injury or death, property damage or economic loss.



**ATTENTION:** Identifies information about practices or circumstances that can cause injury or death.



**CAUTION:** Identifies information about practices or circumstances that can cause property damage or economic loss.



**BURN HAZARD:** Identifies where a surface can reach dangerous temperatures. If a warning label is fitted, it can be on or inside the equipment.



This symbol identifies items which must be thought about and put in place when designing and assembling a Trusted controller for use in a Safety Instrumented Function (SIF). It appears extensively in the Trusted Safety Manual.

### IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

### NOTE

Provides key information about the product or service.

### TIP

Tips give helpful information about using or setting up the equipment.

**WARNINGS AND CAUTIONS**

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**WARNING: EXPLOSION RISK**

Do not connect or disconnect equipment while the circuit is live or unless the area is known to be free of ignitable concentrations or equivalent

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**AVERTISSEMENT - RISQUE D'EXPLOSION**

Ne pas connecter ou déconnecter l'équipement alors qu'il est sous tension, sauf si l'environnement est exempt de concentrations inflammables ou équivalente

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**MAINTENANCE**

Maintenance must be carried out only by qualified personnel. Failure to follow these instructions may result in personal injury.

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**CAUTION: RADIO FREQUENCY INTERFERENCE**

Most electronic equipment is influenced by Radio Frequency Interference. Caution should be exercised with regard to the use of portable communications equipment around such equipment. Signs should be posted in the vicinity of the equipment cautioning against the use of portable communications equipment.

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**CAUTION:**

The module PCBs contains static sensitive components. Static handling precautions must be observed. DO NOT touch exposed connector pins or attempt to dismantle a module.

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## ISSUE RECORD

Issue	Date	Comments
6	Sep 05	Format
7	Dec 06	TC-305 Pin View
8	Apr 07	TC-310-02 added
9	Sep 07	TC-314-02 added
10	Dec 07	Flame retardance
11	Jul 09	TC-322-02 cable type added
12	April 10	Cable type change TC-302-0x and TC-303-0x
13	Oct 11	Added recommendations for bend radius
14	Apr 16	Rebranded, Reformatted and correction of typographical errors
15	May 17	TC-320-01 cable type added. Not published.
16	Feb 19	Removed information about catalogs that are no longer offered. Added trademarks statement. Updated document to display Rockwell Automation publication numbers.
17	May 19	Added information about -03 (UL) cables.

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## Table of Contents

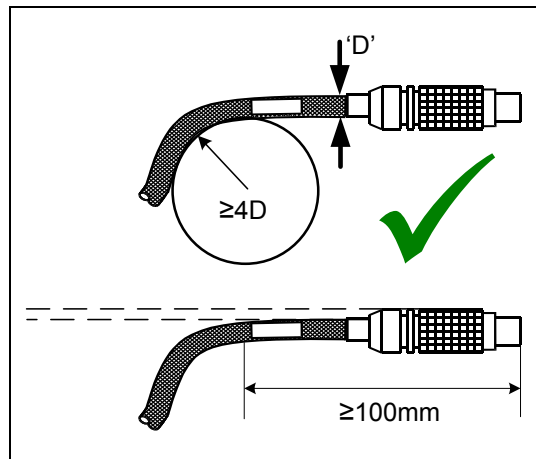
1.	Recommendations .....	3
2.	Communications Cable Type TC-301-0X .....	5
3.	Communications Cable Type TC-302-0X .....	7
4.	Communications Cable Type TC-303-0X .....	9
5.	Communications Cable Type TC-304-01 .....	11
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7.	Communications Cable Type TC-306-0X .....	17
8.	Communications Cable Type TC-308-0X .....	19
9.	Communications Cable Type TC-310-0X .....	21
10.	Communications Cable Type TC-31X-0X .....	23
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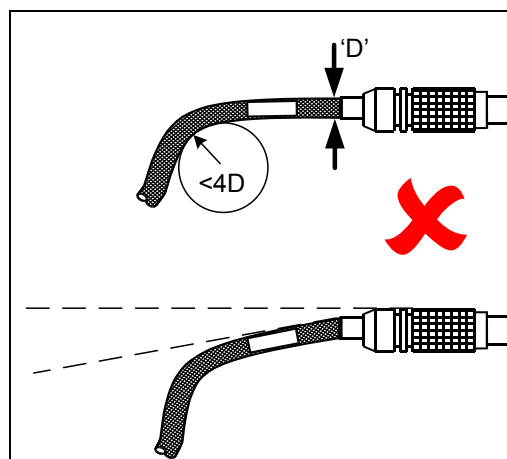
# 1. Recommendations

In order to maintain signal integrity and avoid cable damage it is important not to put lateral strain on the LEMO connectors used on the TC-301, 302, 303, and 314 series cables, or to bend the cables in too small a radius. Undue pulling force when routing the cable should also be avoided.

The bend radius should not be less than 4 times the cable diameter and the cable should be parallel to the connector for a minimum of 100 mm before any bend.



Correct Alignment of Cable

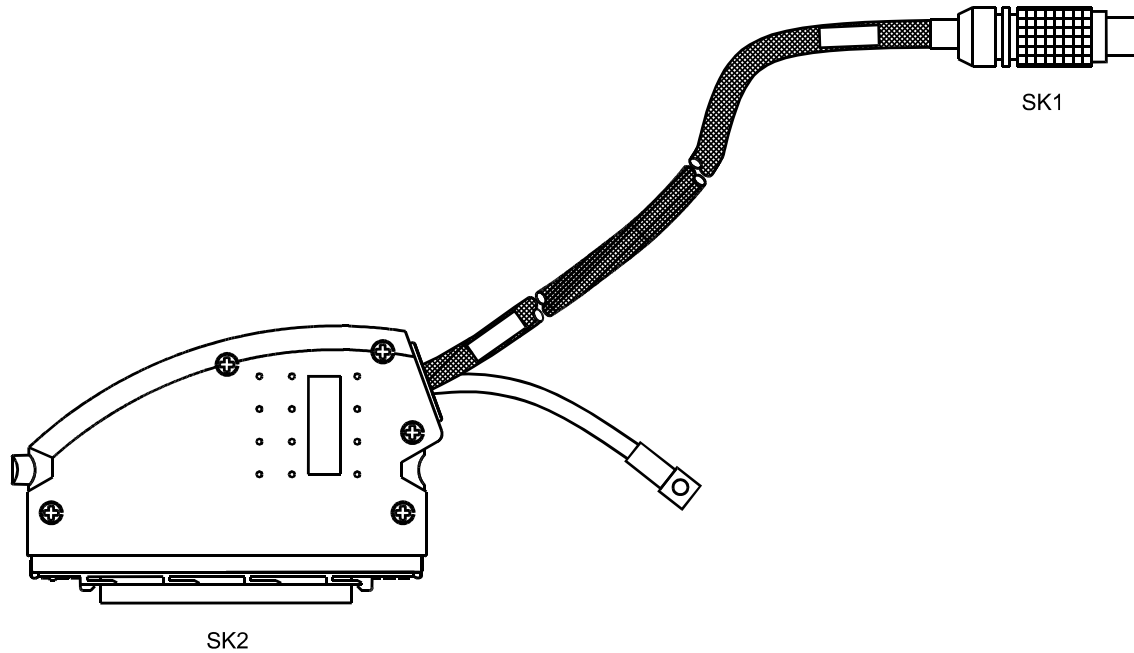


Incorrect Alignment of Cable

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## 2. Communications Cable Type TC-301-0X

This type of Communications Cable is shown in Figure 1 below.



**Figure 1 Communications Cable Type TC-301-0X**

This type of Trusted Communications Cable is designed to connect a Trusted TMR Expander Processor T8310 to the appropriate position on the Trusted Expander Interface Adapter Unit T8312.

The Expander Processor end of the cable (SKT2) is fitted with a 96-way type 'C' connector housed in a double-width hood. The hood is fitted with an earth braid. The Expander Interface Adapter end is fitted with a 12-way LEMO plug.

The cable assembly consists of either:

- Cat 6 Plus, screened with LSZH sheath (TC-301-02), or
- Cat 5e, screened with UL Certified sheath (TC-301-03).

The ends of the sheathing are covered in heatshrink sleeving at one end (LEMO plug) and heated to help prevent fraying.

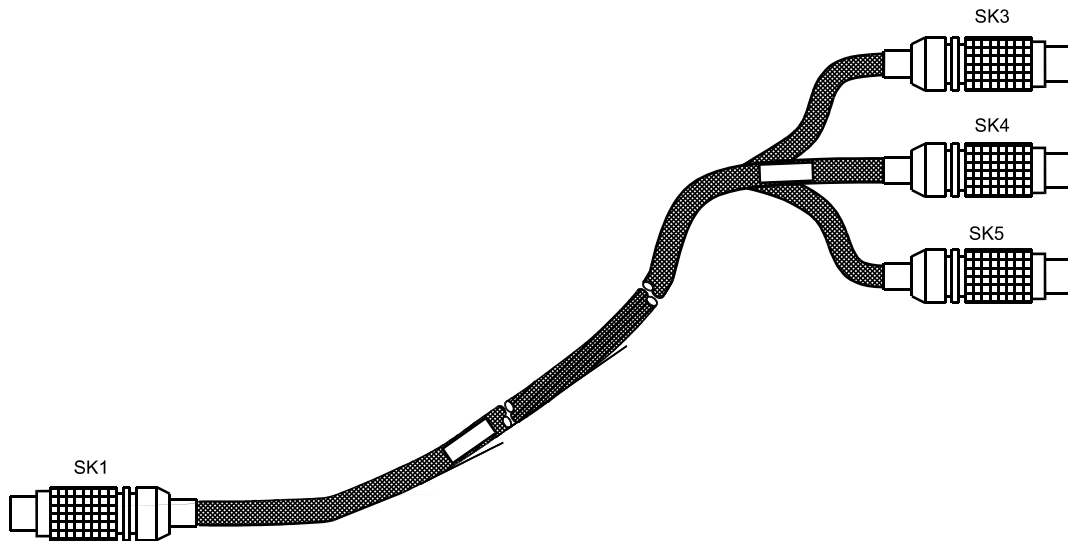
**Maximum length: 30 m.**

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### 3. Communications Cable Type TC-302-0X

This type of Communications Cable is shown in Figure 2 below.



**Figure 2 Communications Cable Type TC-302-0X**

This type of Trusted Communications Cable is designed to connect a specified position on a Trusted Expander Interface Adapter Unit T8312 to a Trusted Fibre TX/RX Unit T8314.

The Expander Interface Adapter end of the cable (SKT1) is fitted with a 12-way LEMO plug. The Fibre TX/RX end is fitted with three 4-way LEMO plugs.

The cable assembly consists of either:

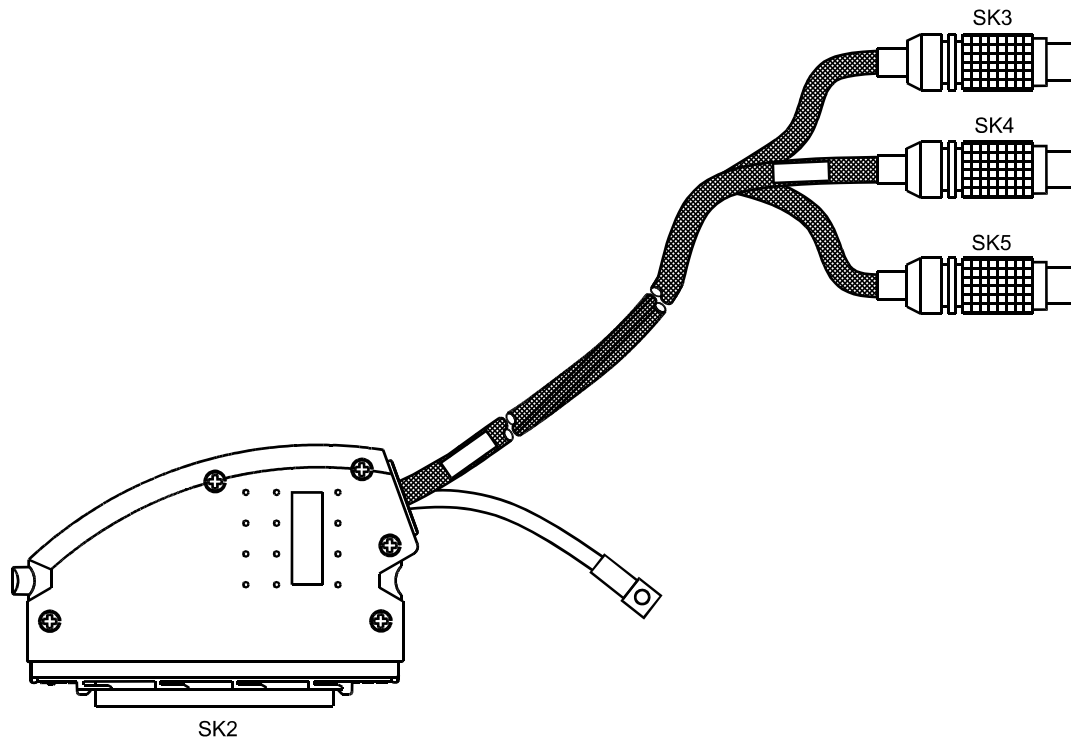
- Cat 5, individually screened with LSZH sheath (TC-302-02), or
- Cat 5, screened UL Certified sheath (TC-302-03).

The ends of the sheathing are covered in heatshrink at both ends (LEMO plug) and heated to help prevent fraying.

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## 4. Communications Cable Type TC-303-0X

This type of Communications Cable is shown in Figure 3 below.



**Figure 3 Communications Cable Type TC-303-0X**

This type of Trusted Communications Cable is designed to connect a Trusted Fibre TX/RX Unit T8314 to a Trusted Expander Processor T8310 located in a remote Trusted Expander Chassis.

The Expander Processor end of the cable (SKT2) is fitted with a 96-way type 'C' connector housed in a double-width hood. The hood is fitted with an earth braid. The Fibre TX/RX Unit end is fitted with three 4-way LEMO plugs.

The cable assembly consists of either:

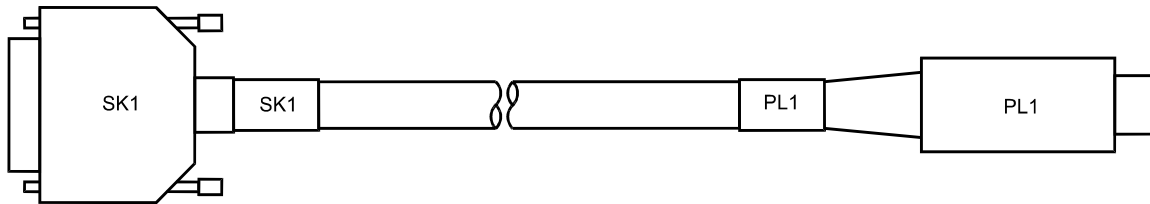
- Cat 5, individually screened with LSZH sheath (TC-303-02), or
- Cat 5, screened UL Certified sheath (TC-303-03).

The ends of the sheathing are covered in heatshrink sleeving and heated to help prevent fraying.

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## 5. Communications Cable Type TC-304-01

This type of Communications Cable is shown in Figure 4 below.



**Figure 4 Communications Cable Type TC-304-01**

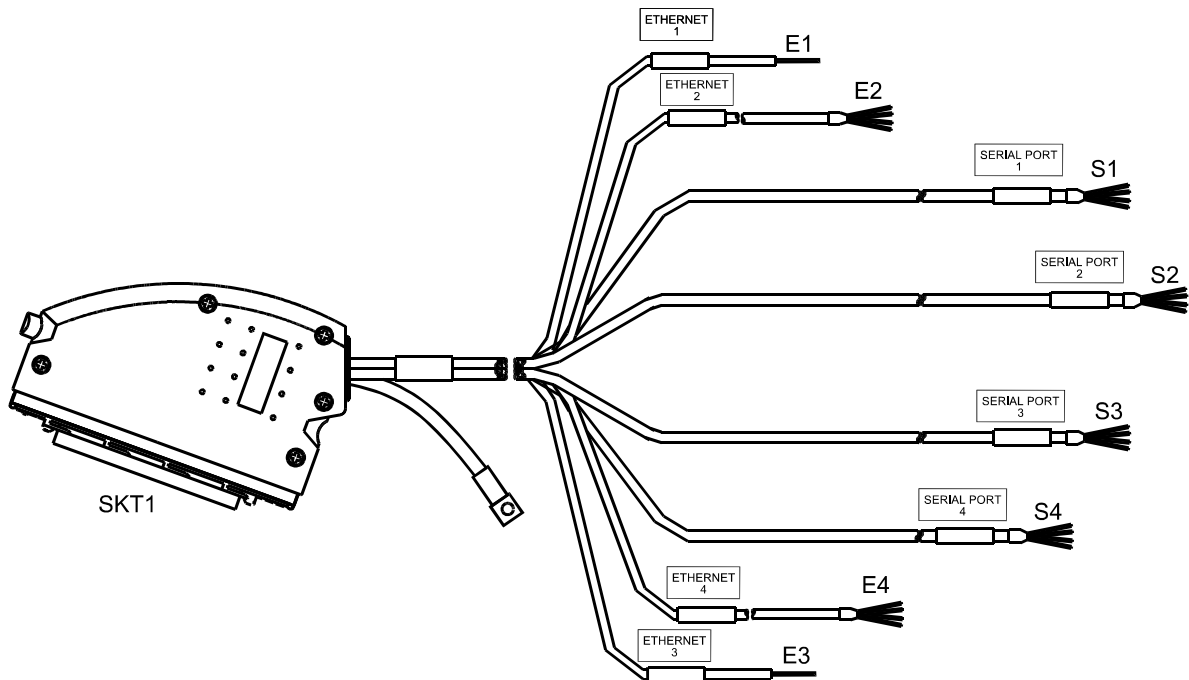
This type of Trusted Communications Cable is designed to connect an Engineering Workstation (EWS) or PC to the front panel RS232 diagnostics port on either the Trusted TMR Processor T8110 or Trusted Communications Interface T8151.

The cable assembly consists of a 6-core Belden 9536 cable fitted with a 9-way 'D' type connector at one end and a 6-way DIN connector at the other.

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## 6. Communications Cable Type TC-305-01

This type of Communications Cable is shown in Figure 5 below.



**Figure 5 Communications Cable Type TC-305-01**

This type of Trusted Communications Cable is designed to provide connection to the communications ports available at the Trusted Communications Interface T8151 via flying leads.

The Communications Interface end of the cable (SKT1) is fitted with a 78+2-way type 'M' connector housed in a single-width hood. The hood is fitted with an earth braid. The other ends of the cable (8-off) are left free. Connectors conforming to user requirements are fitted. Only one, or other type of the Ethernet ports may be used, not both simultaneously.

The cable assembly consists of a Cat 5, screened PVC sheath.

The flying lead end of the sheathing is covered in heatshrink and heated to help prevent fraying. 50  $\Omega$  coaxial cables is supplied for Ethernets E1 and E3.

Refer to Table 2 for details of pin connections, including screening.

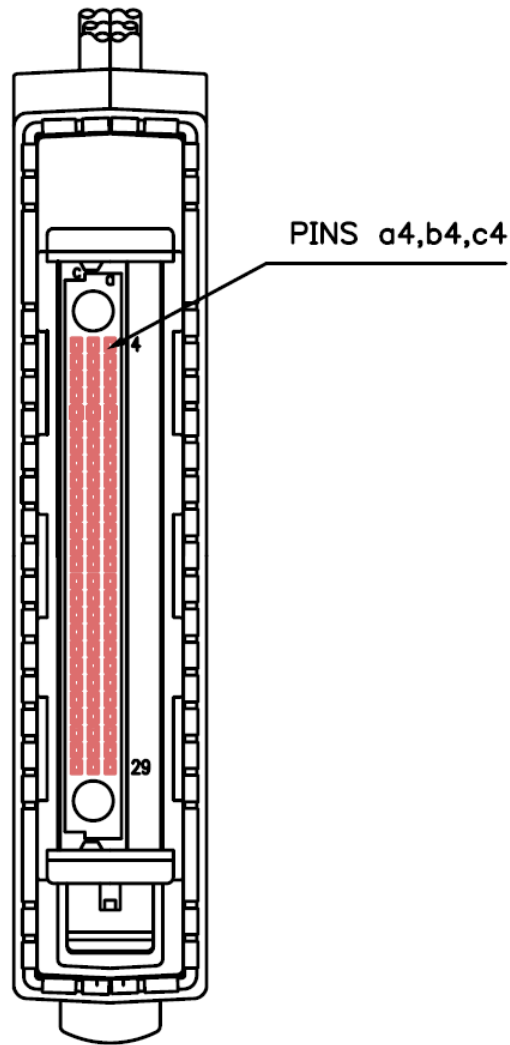


Figure 6 TC-305 Pin arrangement (view of outside of plug)

Connection Type	SK1 Pin	Function	Core Colour
E1 Ethernet 1 10 Base 2	S1	50 Ω CO-AX	INNER CORE
	S1	GND	OUTER SCREEN
E2 Ethernet 2 10 Base T	21a	TD+1	WH/OG
	21b	TD-1	OG
	22a	RD+1	WH/GN
	22b	RD-1	GN
			SCREEN



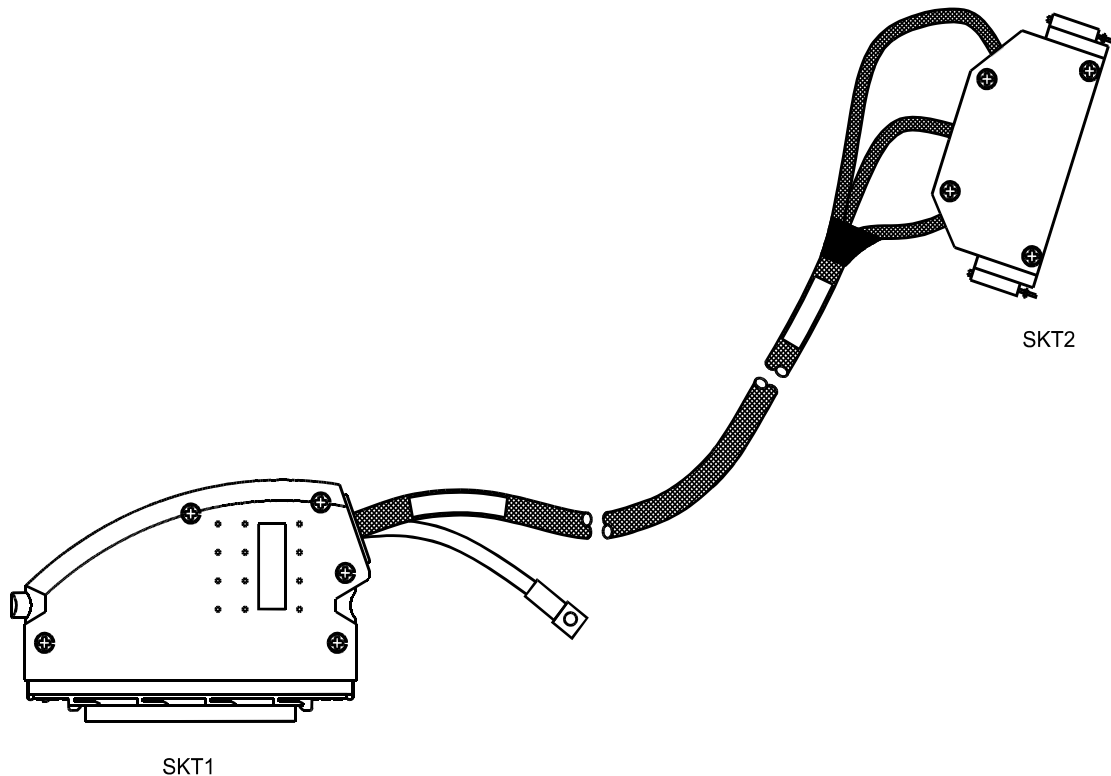
Connection Type	SK1 Pin	Function	Core Colour
E3 Ethernet 3 10 Base 2	S2	50 Ω CO-AX	INNER CORE
	S2	GND	OUTER SCREEN
E4 Ethernet 4 10 Base T	25a	TD+2	WH/OG
	25b	TD-2	OG
	26a	RD+2	WH/BU
	26b	RD-2	BU
			SCREEN
S1 Serial Port 1 RS232 RS422/485	5a	TXD1 RS232	WH/OG
	6a	RTS1 RS232	WH/BN
	6b	DTR1 RS232	WH/BU
	6c	RXD1 RS232	OG
	7a	CTS1 RS232	BN
	7b	DSR1 RS232	BU
	8a	RXB1 RS422/485	BN
	8b	RXA1 RS422/485	WH/BN
	9a	TXB1 RS422	WH/BU
	9b	TXAO RS422	BU
	9c	GND 0 RS232	SCREEN
	4c to 29a	LINK RS232	
S2 Serial Port 2 RS232 RS422/485	11a	TXD2 RS232	WH/OG
	11c	RXD2 RS232	OG
	12a	RXB2 RS422/485	BN
	12b	RXA2 RS422/485	WH/BN
	13a	TXB2 RS422	WH/BU

Connection Type	SK1 Pin	Function	Core Colour
	13b	TXA2 RS422	BU
	13c	GND 2	SCREEN
S3 Serial Port 3 RS422/485	15a	RXB3 RS422/485	WH/OG
	15b	RXA3 RS422/485	OG
	16a	TXB3 RS422	WH/BU
	16b	TXA3 RS422	BU
	16c	GND 3	SCREEN
S4 Serial Port 4 RS232 RS422/485	18a	RXB4 RS422/485	WH/OG
	18b	RXA4 RS422/485	OG
	19a	TXB4 RS422	WH/BU
	19b	TXA4 RS422	BU
	19c	GND4	SCREEN

Table 2 TC-305-01 Pin Connections

## 7. Communications Cable Type TC-306-0X

This type of Communications Cable is shown in Figure 7 below.



**Figure 7 Communications Cable Type TC-306-0X**

This type of Trusted Communications Cable is designed to provide I/O connection between a faulty Trusted Analogue or Digital Input module (40/60 Channel) and the I/O module occupying the SmartSlot position in a Trusted Controller or Expander Chassis.

The SmartSlot end of the cable (SKT1) is fitted with a 96-way type 'C' connector housed in a single-width hood. The hood is fitted with an earth braid. The faulty I/O module end is fitted with a 96-way type 'R' connector housed in a special-to-type plastic hood.

The cable assembly consists of either:

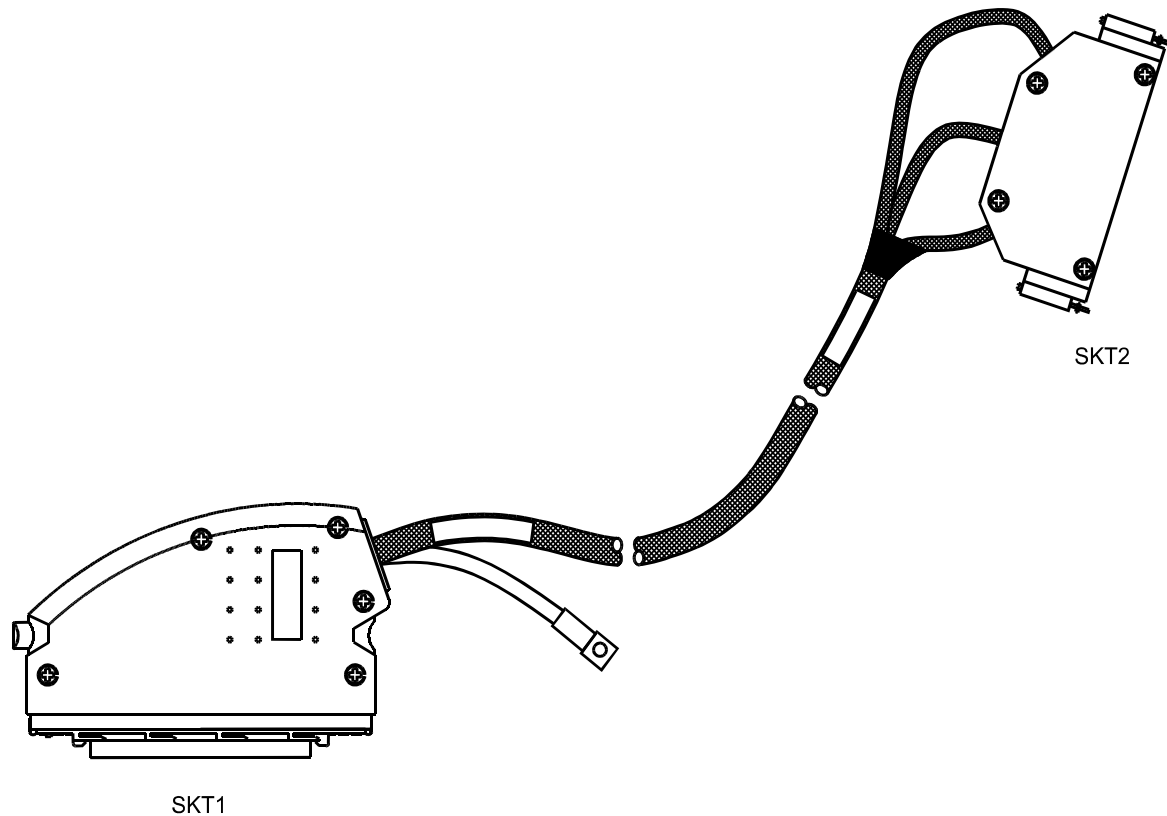
- 96-way LSZH wire harnesses shrouded in Megamide Sleeving (TC-306-02), or
- 96-way UL Certified wire harnesses shrouded in Megamide Sleeving (TC-306-03).

The ends of the sheathing are covered in heatshrink sleeving and heated to help prevent fraying.

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## 8. Communications Cable Type TC-308-0X

This type of Communications Cable is shown in Figure 8 below.



**Figure 8 Communications Cable Type TC-308-0X**

This type of Trusted Communications Cable is designed to provide I/O connection between a faulty Trusted Digital Output module (40 Channel only) and the I/O module occupying the SmartSlot position in a Trusted Controller or Expander Chassis.

The SmartSlot end of the cable (SKT1) is fitted with a 96-way type 'C' connector housed in a single-width hood. The hood is fitted with an earth braid. The faulty I/O module end is fitted with a 96-way type 'R' connector housed in a special-to-type plastic hood.

The cable assembly consists of either:

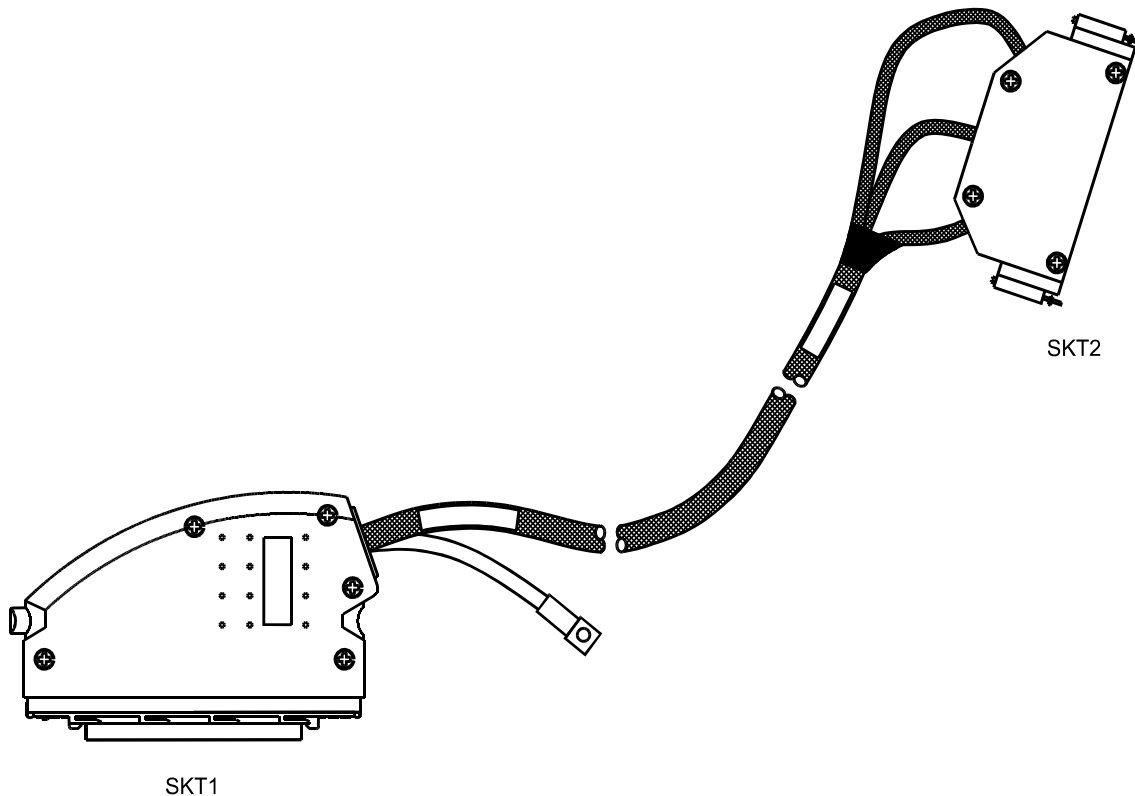
- 56-way LSZH wire harnesses shrouded in Megamide Sleeving (TC-308-02), or
- 56-way UL Certified wire harnesses shrouded in Megamide Sleeving (TC-308-03)

The ends of the sheathing are covered in heatshrink sleeving and heated to help prevent fraying.

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## 9. Communications Cable Type TC-310-0X

This type of Communications Cable is shown in Figure 9 below.



**Figure 9 Communications Cable Type TC-310-0X**

This type of Trusted Communications Cable is designed to provide I/O connection between a faulty Trusted T8472 Digital Output Module (16 Channel only) and the I/O module occupying the SmartSlot position in a Trusted Controller or Expander Chassis.

The SmartSlot end of the cable (SKT1) is fitted with a 32-way type 'D' connector housed in a single-width hood. The hood is fitted with an earth braid. The faulty I/O module end is fitted with a 32-way type 'R' connector housed in a special-to-type plastic hood.

The cable assembly consists of either:

- 8-way and 3-way LSZH cables shrouded in Megamide Sleeving (TC-310-02), or
- 8-way and 3-way UL Certified cables shrouded in Megamide Sleeving (TC-310-03).

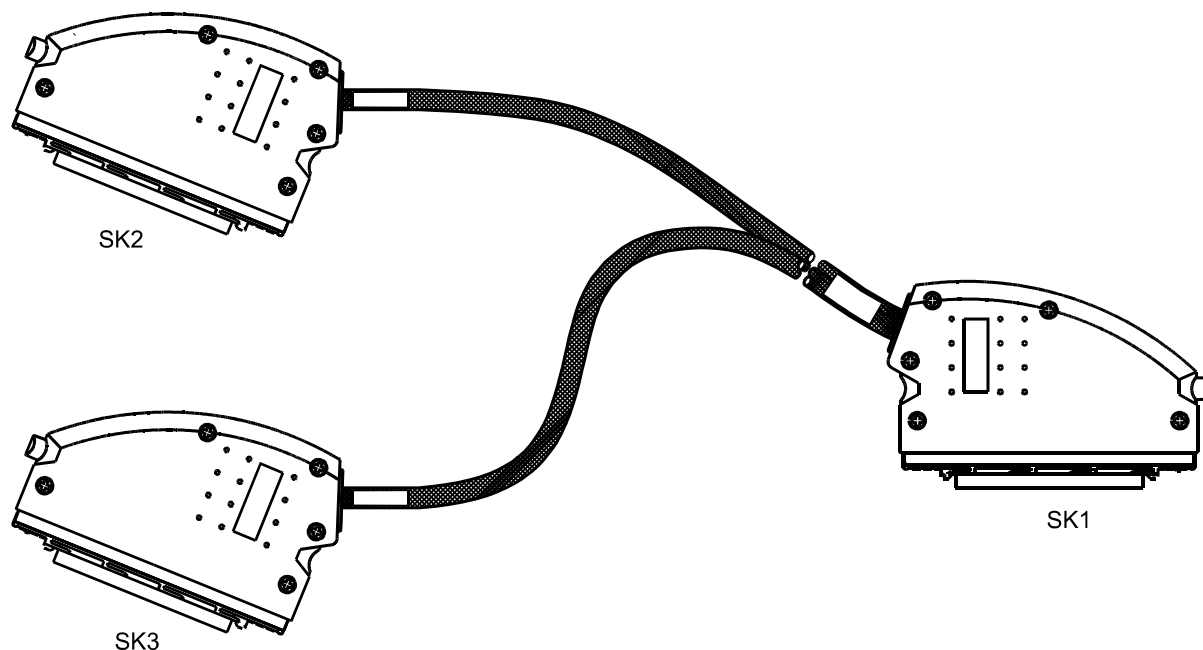
The ends of the sheathing are covered in heatshrink sleeving and heated to help prevent fraying.

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## 10. Communications Cable Type TC-31X-0X

This type of Communications Cable is shown in Figure 10 below.



**Figure 10 Communications Cable Type TC-31X-0X**

This type of Trusted Communications Cable is designed to provide the multi-drop connections between the Trusted Expander Interface modules T8311 in the Trusted Controller Chassis and the Trusted TMR Expander Processors T8310 in the Trusted Expander Chassis. There are three variations of this cable as detailed in Table 3 below.

Cable Type	Description
TC-311-02	Local Expansion Cable Assembly, 1 way
TC-311-03	Local Expansion Cable Assembly, 1 way (UL)
TC-312-02	Local Expansion Cable Assembly, 2 way
TC-312-03	Local Expansion Cable Assembly, 2 way (UL)
TC-313-02	Local Expansion Cable Assembly, 3 way
TC-313-03	Local Expansion Cable Assembly, 3 way (UL)

**Table 3 Trusted Communications Cables**

Each end of the cable is fitted with a 96-way type 'C' connector housed in a double-width hood. Each variation of the cable is made up of a number of elements with SKT1 is all cases

being connected to the Trusted Expander Interface modules. The make-up of the cables is detailed in below.

Cable	No. of Elements	Element Length
TC-311-02/0 3	1	SKT1 to SKT2 – 2m0
TC-312-02/0 3	2	SKT1 to SKT2 – 2m0 SKT1 to SKT3 – 2m5
TC-313-02/0 3	3	SKT1 to SKT2 – 2m0 SKT1 to SKT3 – 2m5 SKT1 to SKT4 – 3m0

The cable assembly consists of either:

- Cat 6 Plus, screened with LSZH sheath (TC-31X-02), or
- Cat 5e, screened UL Certified sheath (TC-31X-03).

Both ends of the sheathing are covered in heatshrink sleeving and heated to help prevent fraying.

## 11. Communications Cable Type TC-314-0X

This type of Communications Cable is shown in Figure 11 below.



**Figure 11 Communications Cable Type TC-314-0X**

This type of Trusted Communications Cable is designed to connect communications between a T8312 Trusted Processor Interface Adapter and a T8310 Expander Processor, to extend electrical connection between a Processor chassis and an expander chassis to a total of up to 36 m. Three TC-314-0X cables are required per expander chassis, thus it also provides the chance for diverse routing. The cables link between a TC-302-0X cable and a TC-303-0X cable, as if an electrical version of a fibre optic extension.

The cable is fitted with two identical 4-way round connectors. At the Processor chassis end, the connector fits one plug on a TC-302-0X cable, usually used to connect a T8312 Expander Interface Adapter to T8314 fibre optic converters. At the expander chassis end, the connector fits one plug on a TC-303-0X cable, usually used to connect the other end of a fibre optic connection to the expander chassis. Each TC-314-0X cable carries one transmit/receive balanced communications pair between the expander interface and the expander processor. Three TC-314-0X cables are required in the triplicated connection

The cable assembly consists of either:

- a length of 4 pair Cat 6 or Cat 7 LSZH screened cable (TC-314-02), or
- a length of 4 pair Cat 5e or Cat 7 UL Certified cable (TC-314-03)

The ends of the sheathing are taken inside a bend relief cable boot at each end. The cable can be supplied to a maximum length of 30 m and the total cable length (TC-302-0X - TC-314-0X - TC-303-0X) cannot exceed 36 m.