GSM Deployment Guide to 120-Ohm Transmission for Wireless Products

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Contents

Introduction

This document describes basic information about 120-ohm twisted pairs (TPs), specifications of Huawei 120-ohm cables, common 120-ohm equipment, and construction methods. The intended audience of this document is the personnel who are unfamiliar with the 120-ohm TPs.

This document provides a comprehensive description of 120-ohm TPs, including methods for using loopback connectors and for determining crossed pairs.

Engineers can improve 120-ohm engineering experience, knowledge and skills by reading this document.

1 Background

1.1 TP (Twisted Pairs)

The TP is the most common transmission media in engineering. A TP includes two copper wires that are each protected by a protective insulating layer. The two copper wires insulated from each other are twisted together at a certain density. Thus, the interference to signals is reduced, and the electric wave radiated from a wire during transmission is canceled out by the electric wave radiated from the other wire. One or more TPs arranged in an insulating sheath form a TP cable.

Different TPs have different twist lengths. Generally, the twist lengths are from 38.1 cm to 14 cm, the pair wires are twisted counterclockwise, and the twist length of adjacent pair wires is over 12.7 cm. Compared with other transmission media, the TP is limited by the transmission distance, channel width, and data transmission rate, but is less expensive. Currently, the TP is categorized into unshielded twisted pair (UTP) and shielded twisted pair (STP). Telecommunication networks mostly use 120-ohm STP, which is the focus of this document.

The features of the 120-ohm STP are as follows:

- Lowest cost
- Small diameter, space saving

- Light weight, flexibility, easy installation
- Minimum or no crosstalk

1.2 Coaxial Cable

A coaxial cable is formed by a core of hard copper wires, and is shielded by an insulating material layer. The insulating material is surrounded by the densely woven conductive mesh and the mesh is covered by a protective material layer. There two types of coaxial cables, namely, 50-ohm cables and 75-ohm cables, are widely used now. Huawei equipment all uses the 75-ohm cables for historical rather than technical or manufacturing reasons.

The features of the coaxial cables are as follows:

- Cost higher than TP cables but lower than optical cables
- Convenient maintenance
- High reliability, improved network resistance to interference, and better resistance to interference than the TP cables at high frequencies
- Large geographical coverage, and realizing a data transmission rate of 1 Gbit/s to 2 Gbit/s even on a one-kilometer-long cable

1.3 Comparison between Common Transmission Media

Transmission Media	Rate	Transmission Distance	Anti-Interference Capability	Price	Application	Example
TP Cable	Analog 300–3400 Hz; Digital 10–100 Mbps	Tens of kilometers	Acceptable	Low	Analog transmission Digital transmission	User loop line Local area network
75 W Coaxial Cable	Analog 300–450 MHz Digital 1 Gbit/s to 2Gbit/s at most	100 kilometers	Good	High	Analog transmission, allowing mixed transmission of TV, data, and CD audio in multiple channels	CATV Telecommunication transmission
Optical cable	100 Mbit/s to Thousands	30 kilometers	Very good	High	Long-distance	Backbone

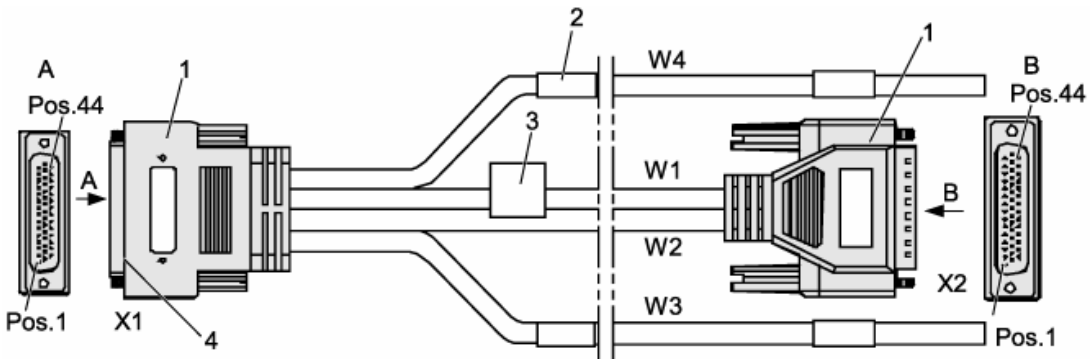
	of Mbit/s				transmission	network
Microwave	Tens to hundreds of bit/s	Global	Average, poor communication quality	Low	Long-distance low-speed communication	Broadcast
Terrestrial Microwave Relay	4 GHz to 6 GHz	Hundreds kilometers	Very good	Lower than that of cables of the same capacity and length	Remote communication	Television
Satellite	4 GHz to 14 GHz	Over 36,000 kilometers	Very good	Irrelevant to distance	Remote communication	Television, telephone, data

2 Introduction to Huawei Cables for 120-Ohm Transmission

2.1 Introduction to 120-Ohm Cables for BSC6000

I. Appearance

The following figure shows the active/standby 120-ohm TP cable.



1. DB44 connector	2. Label (marking one of the TPs)

3. Main label (marking the BOM code, version, and manufacturer information about the cable)	4. Shell (metal shell of the DB44 connector)

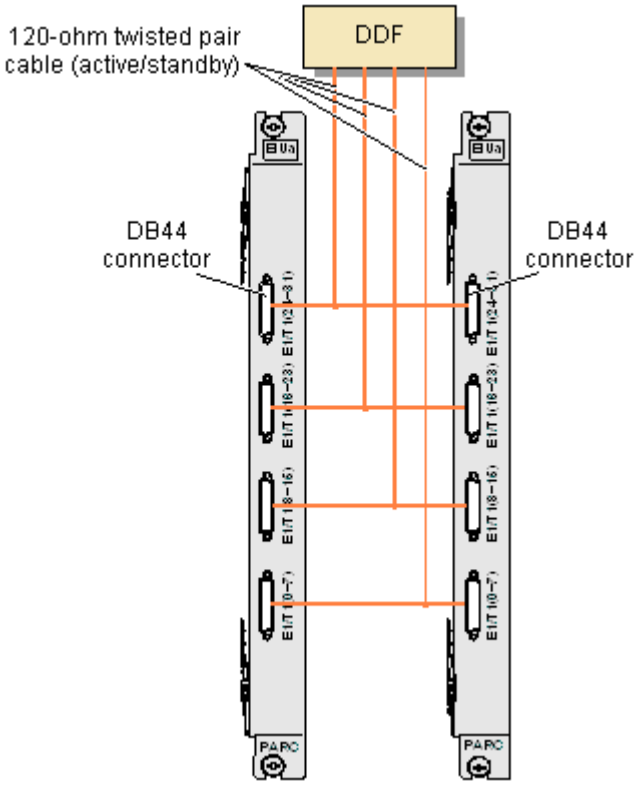
In the previous figure, W3 and W4 are at one end of the 120-ohm TP cable. This end is bare wires. The connector at this end is made according to actual requirements. X1 and X2 are used to connect the DB44 connectors on the active and standby GEIUA/GEIUB/GEIUP/GEIUT boards. W1 and W2 are used to connect X1 to X2.

Photos:

W3 and W4 are attached with labels. Pay attention to "R" and "T".

II. Installation Position

The active and standby DB44 connectors of the active/standby 120-ohm TP cable are connected to the active and standby GEIUA/GEIUB/GEIUP/GEIUT boards respectively. The other end of the cable is connected to the digital distribution frame (DDF) in the equipment room, and then is connected to other network elements (NEs) through transmission devices, or is directly connected to other NEs.



III. Pin Assignment

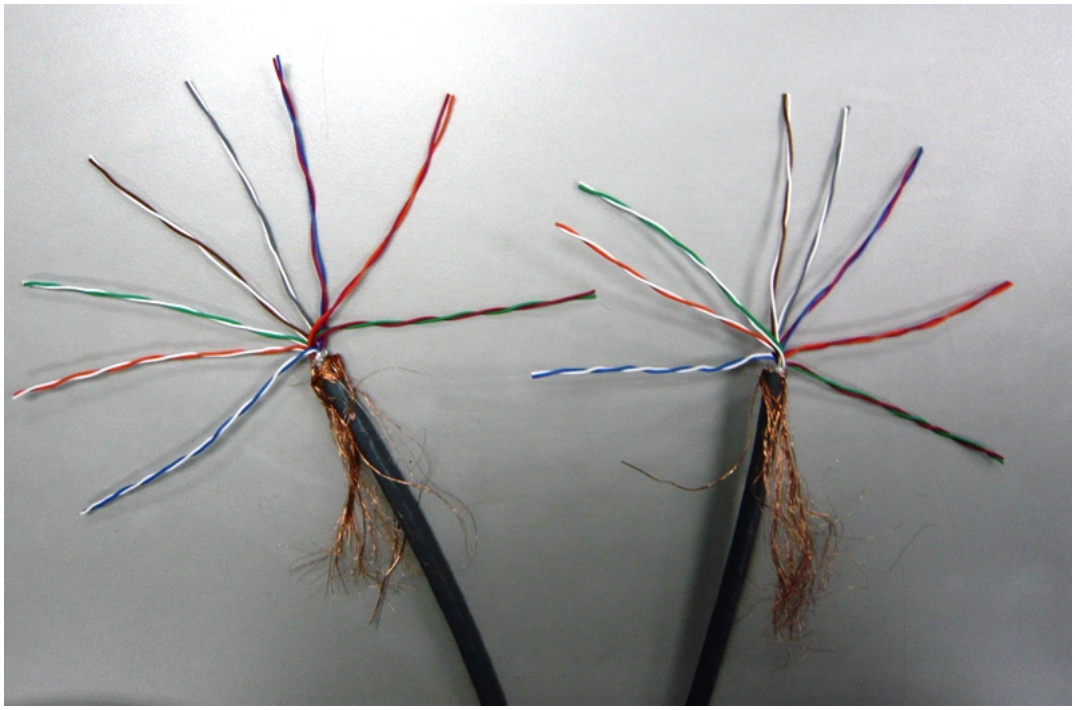
The following table lists the mapping between the active/standby 120-ohm TP cable and the DB44 connector. In the following table, "R-", "R+" and "T-", "T+" both represents a pair of signals transmitted in opposite directions.

Table 2-1 Mapping between the active/standby 120-ohm TP cable and the connector

TP	E1 No.	RX or TX TP Label	Signal	Color	DB44 Pin
W3	1	CHAN 0 TX T1	TT0	White	30
			TR0	Blue	15
W4		CHAN 0 RX R1	RT0	White	23
			RR0	Blue	38
W3	2	CHAN 1 TX T2	TT1	White	29
			TR1	Orange	14
W4		CHAN 1 RX	RT1	White	22

		R2	RR1	Orange	37
W3	3	CHAN 2 TX T3	TT2	White	28
			TR2	Green	13
W4		CHAN 2 RX R3	RT2	White	21
			RR2	Green	36
W3	4	CHAN 3 TX T4	TT3	White	27
			TR3	Brown	12
W4		CHAN 3 RX R4	RT3	White	20
			RR3	Brown	35
W3	5	CHAN 4 TX T5	TT4	White	26
			TR4	Gray	11
W4		CHAN 4 RX R5	RT4	White	19
			RR4	Gray	34
W3	6	CHAN 5 TX T6	TT5	Red	25
			TR5	Blue	10
W4		CHAN 5 RX R6	RT5	Red	18
			RR5	Blue	33
		CHAN 6 TX T7	TT6	Red	24
			TR6	Orange	9
W4		CHAN 6 RX R7	RT6	Red	17
			RR6	Orange	32
W3	8	CHAN 7 TX T8	TT7	Red	7
			TR7	Green	8
W4		CHAN 7 RX R8	RT7	Red	16
			RR7	Green	31

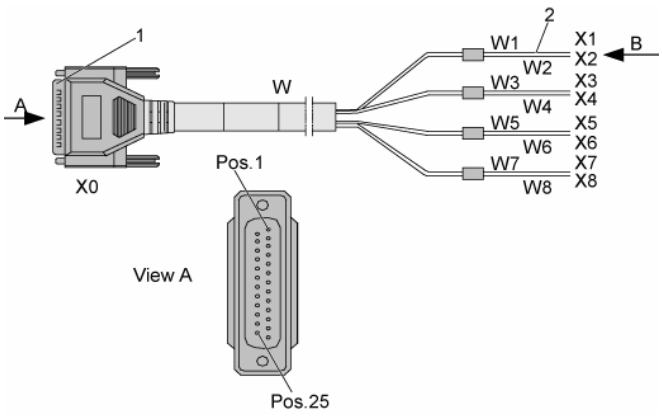
The following is a photo of E1 wires arranged in order:



2.2 Introduction to 120-Ohm Cables for BTS3012/BTS3012AE

I. Appearance

The 120-ohm E1 cable includes four 120-ohm TPs, in which each TP forms a channel. Therefore, one 120-ohm E1 cable provides four E1 channels. One end of the 120-ohm E1 cable is a DB25 male connector. The other end is bare wires, and the connector at this end is made according to actual requirement. The following figure shows the 120-ohm E1 cable.



1. DB25 male connector (X0)	2. 120-ohm TP cable (X1–X8)

II. Pin Assignment

The following table lists the mapping between the pins and core wires of the 120-ohm E1 cable.

Table 2-2 Mapping between the pins and core wires of the 120-ohm E1 cable

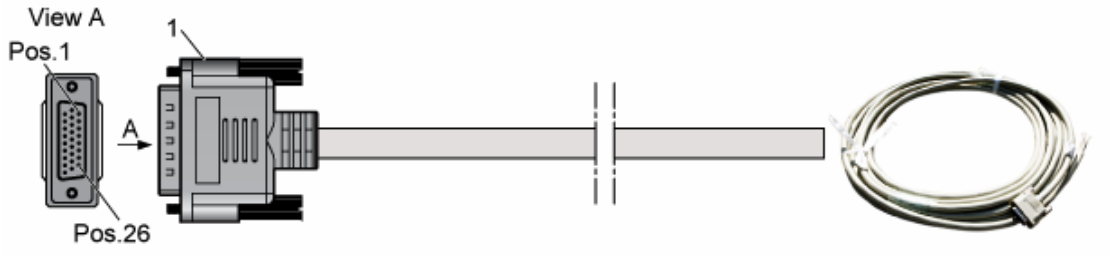
Core Wire	E1 No.	TX or RX TP Label	Signal	Color of the Core Wire	Pin of the DB25 Male Connector
W1	1	CHAN 0 TX T1	TT0	White	X0.24
			TR0	Blue	X0.25
W2		CHAN 0 RX R1	RT0	White	X0.13
			RR0	Orange	X0.12
W3	2	CHAN 1 TX T2	TT1	White	X0.11
			TR1	Green	X0.10
W4		CHAN 1 RX R2	RT1	White	X0.9
			RR1	Brown	X0.8
W5	3	CHAN 2 TX T3	TT2	White	X0.7
			TR2	Gray	X0.6
W6		CHAN 2 RX R3	RT2	Red	X0.5
			RR2	Blue	X0.4
W7	4	CHAN 3 TX T4	TT3	Red	X0.3
			TR3	Orange	X0.2
W8		CHAN 3 RX R4	RT3	Red	X0.14
			RR3	Green	X0.15

2.3 Introduction to 120-Ohm Cables for BTS3036/BTS3036 BBU

I. Appearance

The E1/T1 cable is classified into the 75-ohm E1 coaxial cable and 120-ohm E1 TP cable. One end of the E1/T1 cable is a DB26 male connector and the connector at the other end must be made according to actual requirements.

The following figure shows the E1/T1 cable.



II. Installation Position

One end of the cable (with the DB26 male connector) is connected to the "OUTSIDE" port on the UELP board or the E1/T1 port on the GTMU board, and the other end of the cable is connected to corresponding auxiliaries.

III. Pin Assignment

The following table lists the mapping between the core wires and pins of the E1/T1 cable.

Table 2-3 Description of the core wires and pins of the 120-ohm E1/T1 cable for the BBU

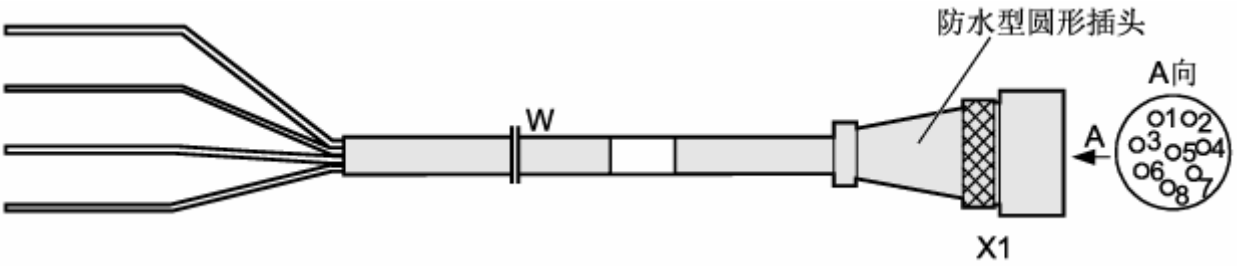
E1 No.	TX or RX TP Label	Signal	Color	Pin of the Male Connector
1	CHAN 0 TX T1	TT0	White	20
		TR0	Gray	19
	CHAN 0 RX R1	RT0	White	2
		RR0	Blue	1
2	CHAN 1 TX T2	TT1	Red	22
		TR1	Blue	21
	CHAN 1 RX R2	RT1	White	4
		RR1	Orange	3
3	CHAN 2 TX T3	TT2	Red	24
		TR2	Orange	23
	CHAN 2 RX R3	RT2	White	6
		RR2	Green	5
4	CHAN 3 TX T4	TT3	Red	26
		TR3	Green	25
	CHAN 3 RX R4	RT3	White	8
		RR3	Brown	7

2.4 Introduction to the E1 Cables for BTS3006C/BTS3002E

I. Appearance

The 120-ohm E1 cable is a TP cable with a length of 3 m. The cable includes four TPs. Every two TPs form a channel. Therefore, one 120-ohm E1 cable provides two E1

channels. One end of the cable is a water-proof round plug, and the other end is bare wires. The connector at the bare wire end is made according to actual requirements. The following figure shows the 120-ohm cable.



II. Installation Position

Cable Name	One End of the Cable	The Other End of the Cable
120-Ohm E1 cable	Water-proof round plug, connected to the E1_0/1 or E1_2/3 port at the bottom of the DMCM module	Bare wires, connected to transmission devices (such as an engineering interface box for indoor transmission)

III. Pin Assignment

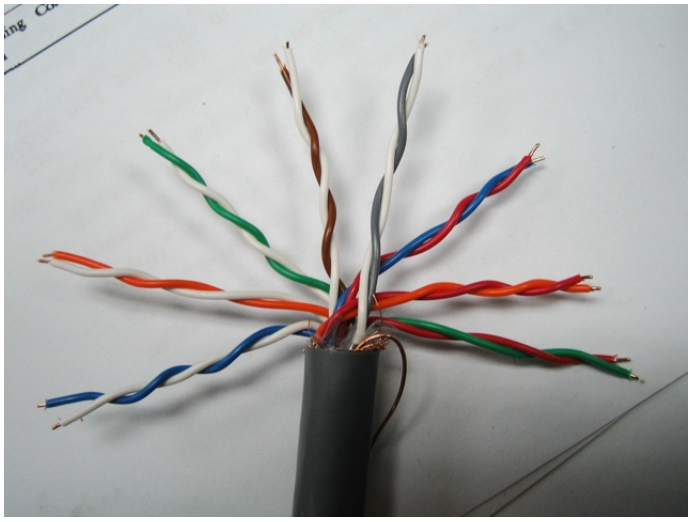
Table 2-4 Mapping between the core wires and pins of the 120-ohm E1/T1 cable for the BTS3006C/BTS3002E

E1 No.	TX or RX TP Label	Signal	Color of the Core Wire	Pin of the Water-Proof Round Plug at the X1 End
1	CHAN 0 TX T1	TT0	White	X1.1
		TR0	Blue	X1.2
	CHAN 0 RX R1	RT0	White	X1.3
		RR0	Orange	X1.4
2	CHAN 1 TX T2	TT1	White	X1.5
		TR1	Green	X1.6
	CHAN 1 RX R2	RT1	White	X1.7
		RR1	Brown	X1.8

3 Introduction to Common 120-Ohm Devices

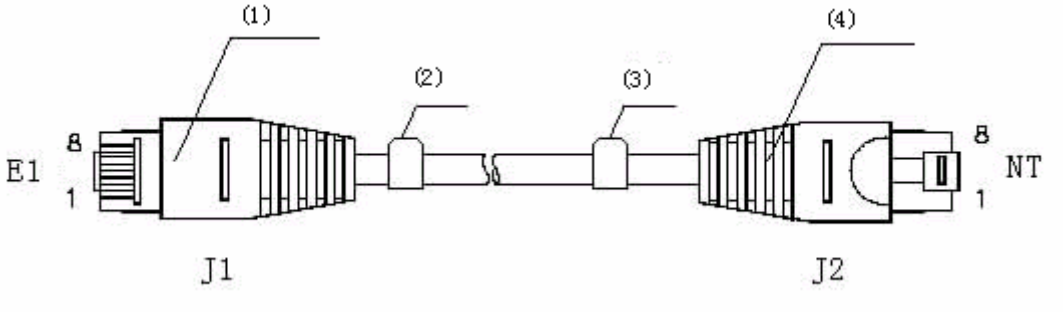
3.1 Introduction to Connectors

- Open



- RJ45

When RJ45 is used as the connector of a 120-ohm TP cable, at most two E1 channels are provided. The connectors of different wire orders must be made according to actual requirements.



(1) RJ45 connector (2) Label 1 (3) Label 2 (4) RJ45 connector

- LEMO

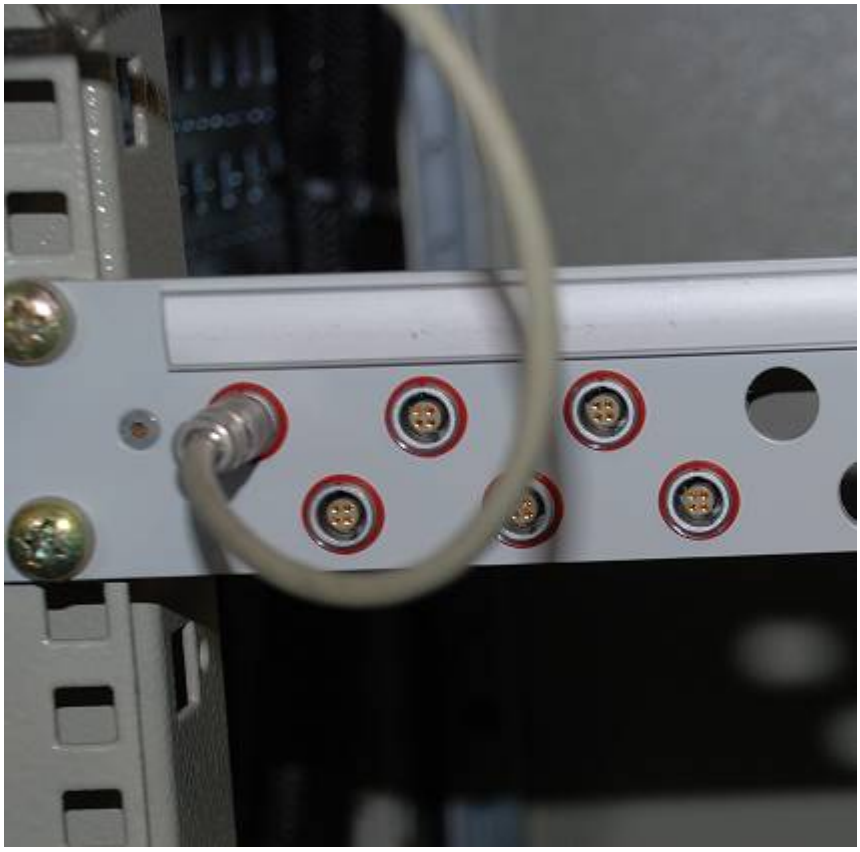
LEMO is a round push-pull self-latching connector.

The features of the LEMO are as follows:

- Fast and convenient to plug and unplug
- Accurate and reliable blind mating

- No magnetism
- High resistance to shock and pulling
- Adaptability to frequent plugging and unplugging (over 1000 times)
- Multiple cores (2–32 cores) or mixed cable types (coaxial cables, high-voltage cables, and optical cables)
- Optional water resistant level of IP64 or IP66

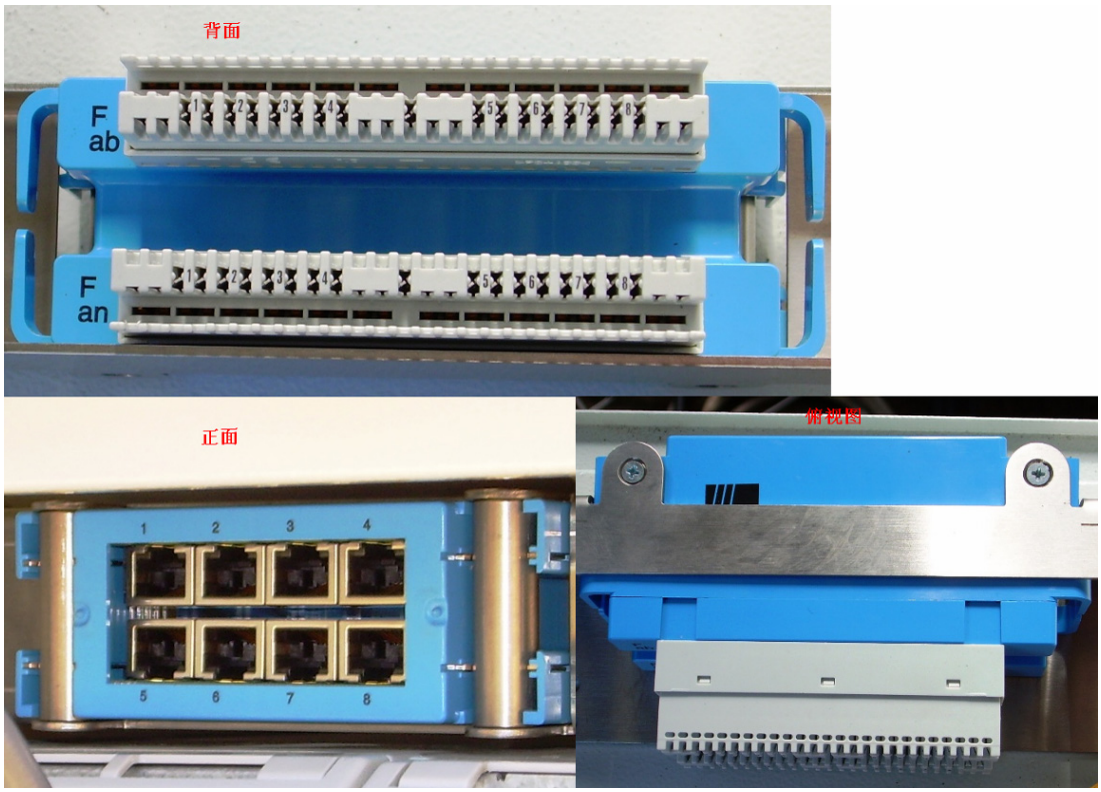
In telecommunication engineering, the most common LEMO connectors are 4-core connectors, which are suitable for transmitting the data on a channel of 120-ohm TP cable. The DDF connectors are supported by the LEMO DDF panel.



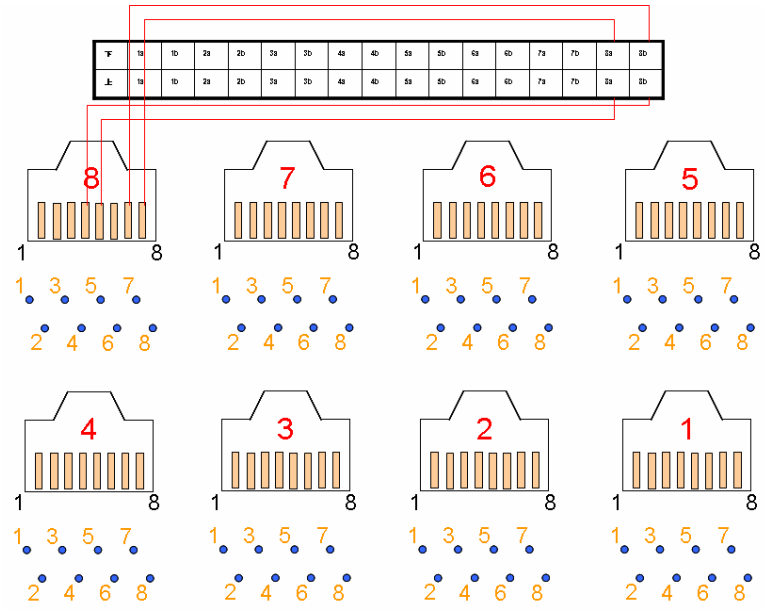
- ATV module

The ATV module is a miniature DDF which turns 120-ohm open wires into an RJ45.

Photos:



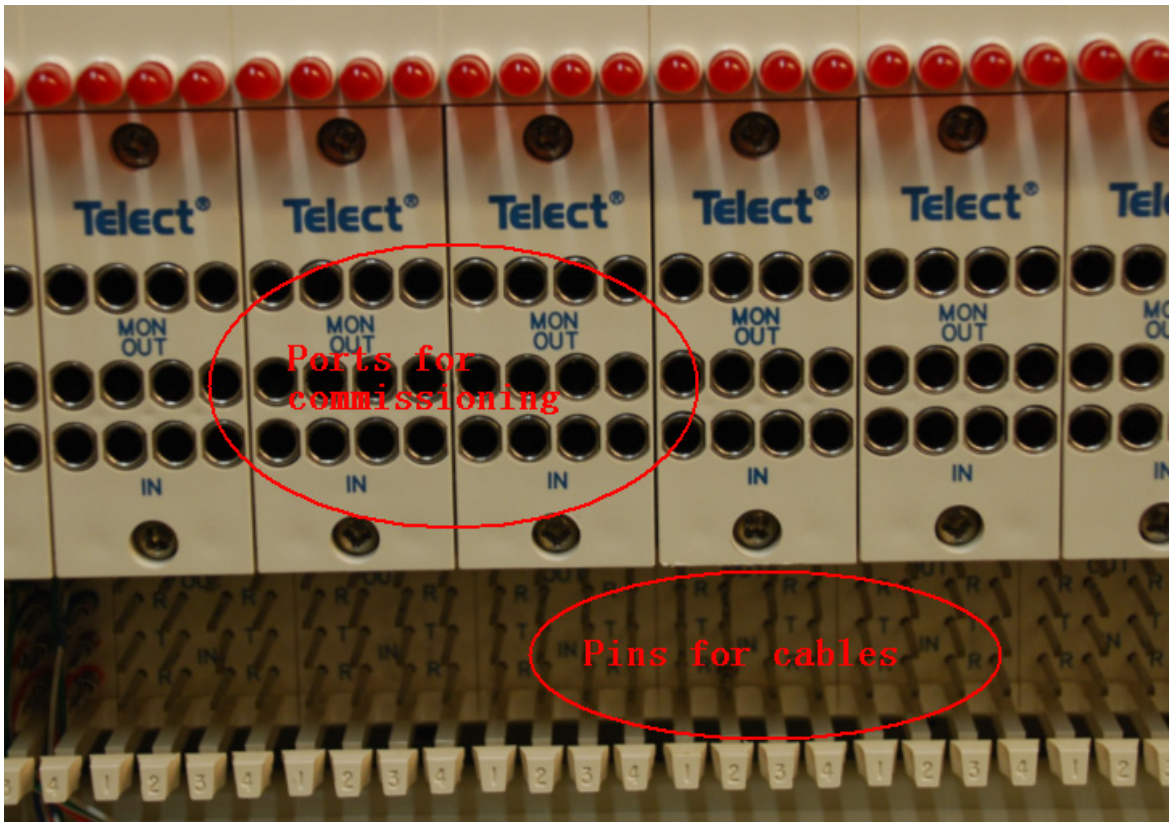
The following figure shows the connections of the ATV panel.

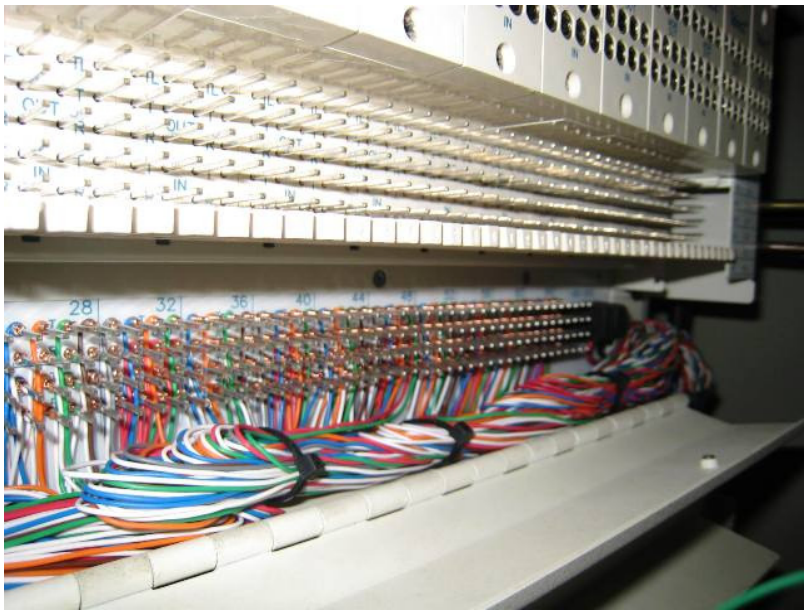


3.2 Introduction to DDF

- DDF TYPE I

DDF TYPE I is commonly applied on the BTS side, and needs a special wire bonding tool (which is expensive).

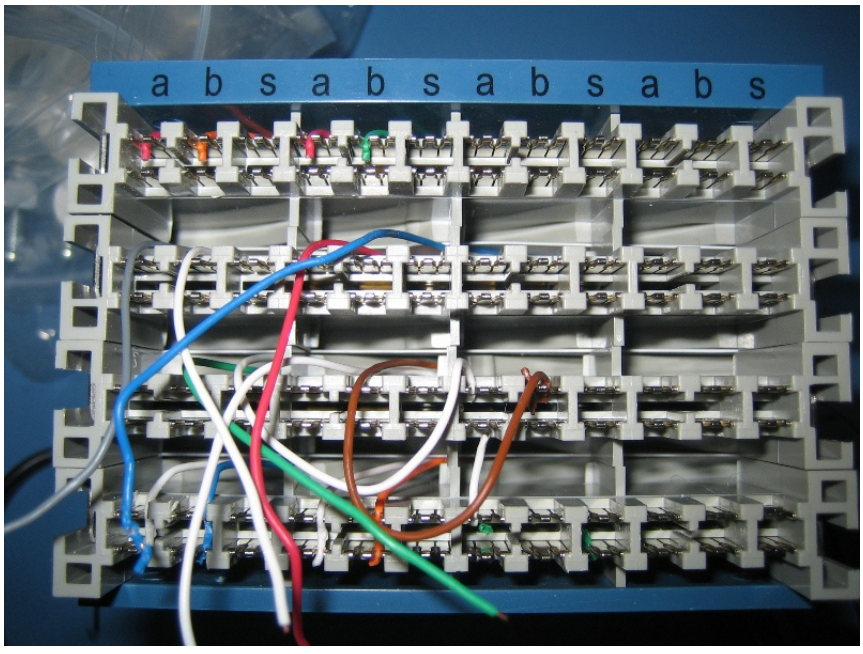




- DDF TYPE II

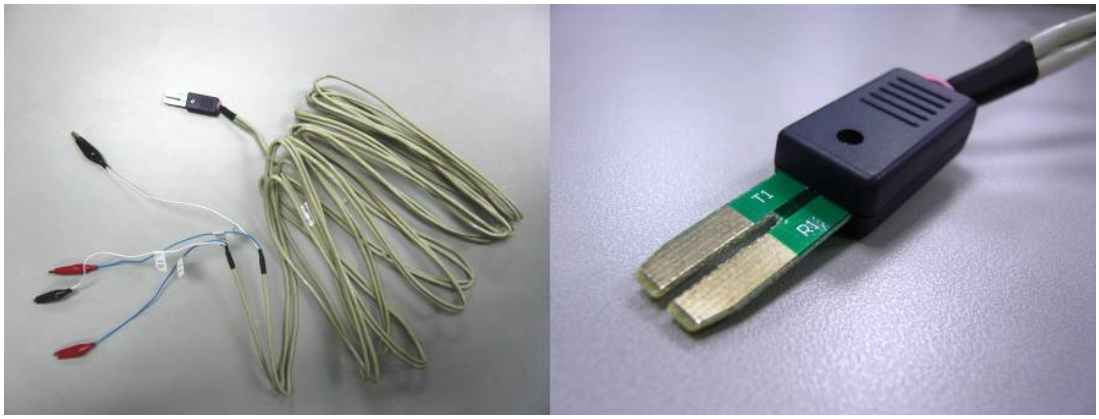
DDF TYPE II is often used in the TC/BSC equipment room, and needs a special wire bonding tool (different from the tool for DDF TYPE I).

The following photo shows the 120-ohm DDF box delivered by Huawei. The wire bonding principle of the box is the same as that of the model in the previous photo. Only the appearances are different.

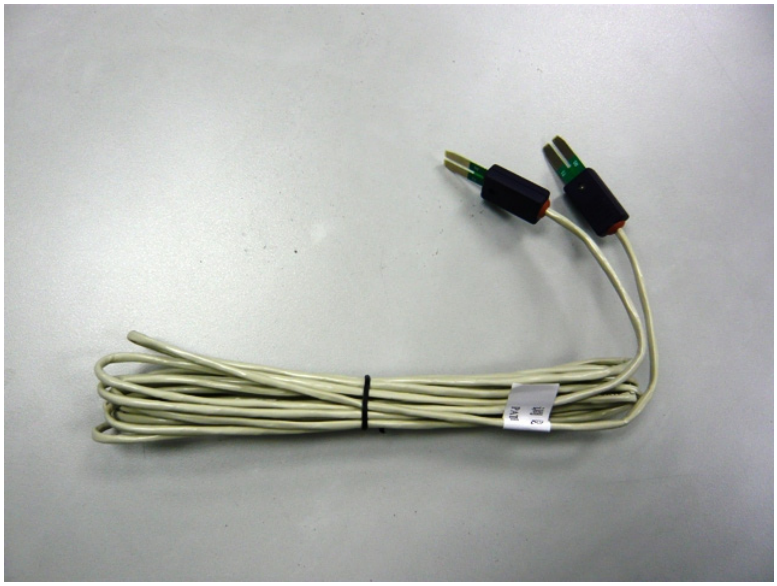


- Delivered commissioning cables

Two types of commissioning cables are delivered.



One end of the commissioning cable is a plug that can be inserted into the DDF box, and the other end has four alligator clips. The cable can be used to perform tests such as conductivity and loopback.



The previous commissioning cable is used for the loopback.

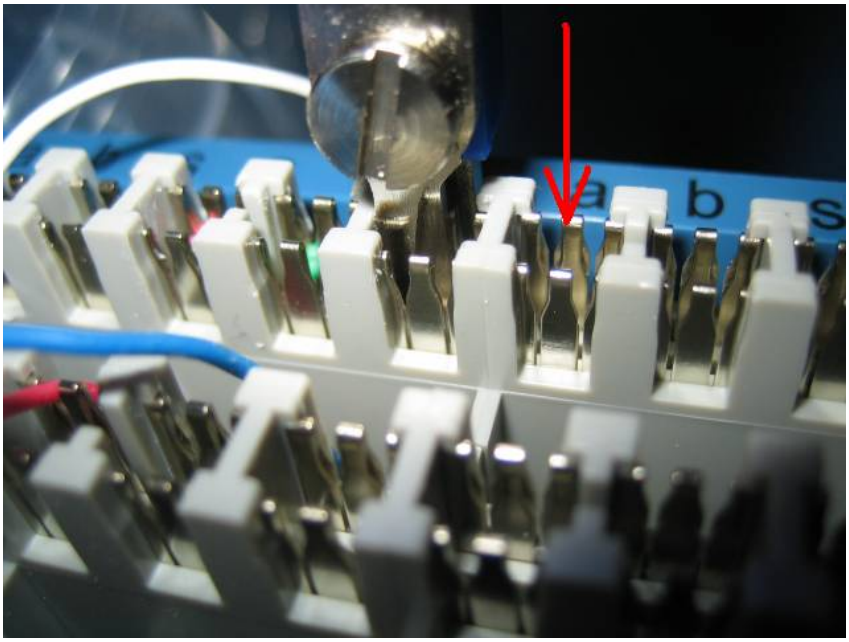
4 Construction Guide

4.1 Wire Bonding Method

For DDF TYPE I, the wire bonding tool shown in the following photo is needed for wire bonding. It is recommended that engineers learn the detailed method for using the wire bonding tool on site.

For DDF TYPE II and DDF TYPE III, the wire bonding tool shown in the following photos is used.

Place the wire in the slot on the DDF, and press the cable with the wire bonding tool. The cable is fastened after you hear a click sound. (It is recommended that engineers learn the detailed method for using the tool on site.)



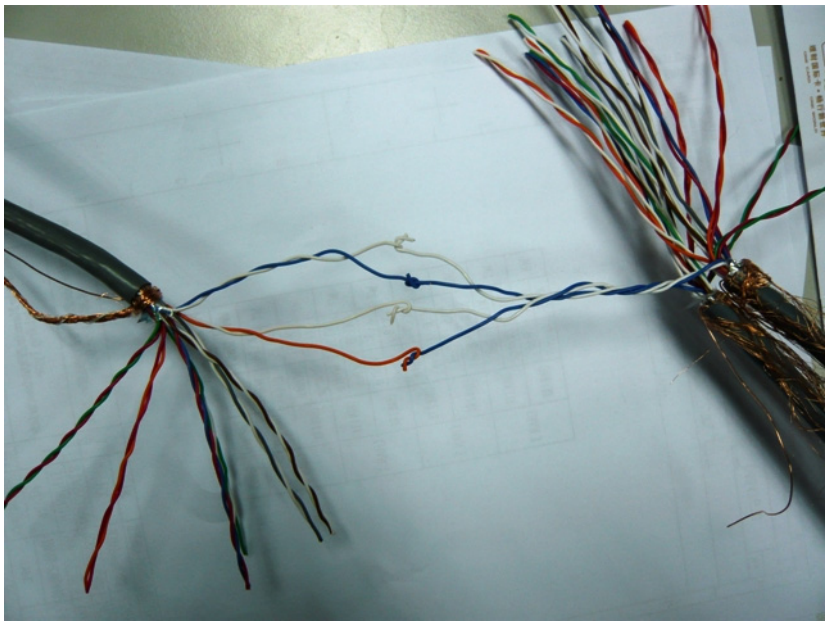
4.2 Wire Bonding Rules

The DDF wires delivered by Huawei are taken as an example to describe the wire bonding principle and method of the 120-ohm wires in the following. (This operation is quite practical. You must take the actual materials and experience by yourself to understand the method thoroughly.)

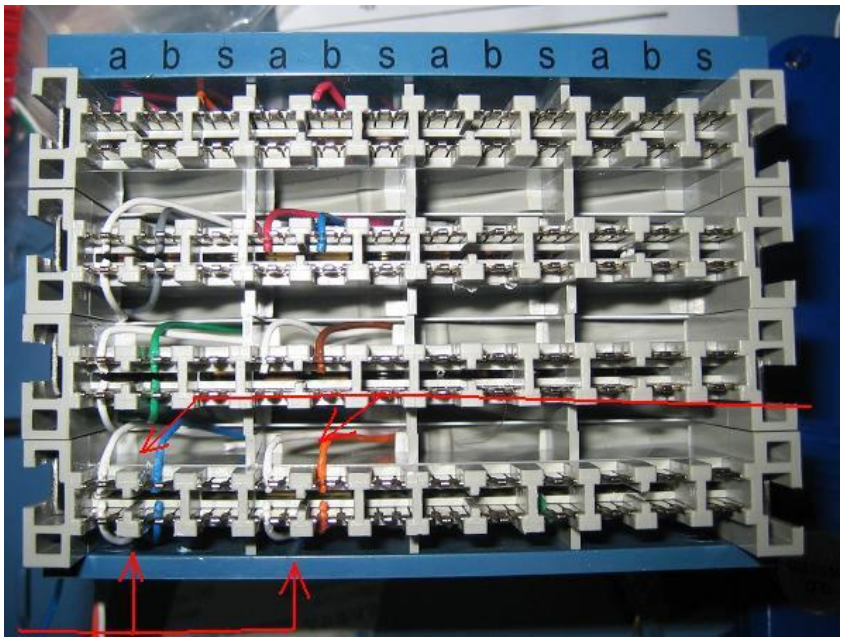
Peel the jacket of the 120-ohm TP cable, and insert the TP cable through holes on the side of the DDF according to the connection requirements. Thus, the cable is guided by a slide, and automatically enters the corresponding area. Normally, the left and right sides of the DDF both have the holes, and the cable from the equipment on a side is inserted into the hole on that side. For example, the cable from the BSC is arranged on the left, and the cable from the BTS is arranged on the right.

Bond the two channels of E1s that need to be connected on the top and bottom of a line in the DDF respectively according to the actual wire sequence on site. Thus, the E1s are connected.

For example, to connect BSC6000 and BTS3012, bond the wires according to the following wire sequence (BSC white-blue-white-blue — BTS white-blue-white-orange).



Bond the upper and lower wires on the DDF according to the wire sequence, or bond the wires according to definitions of the carriers.



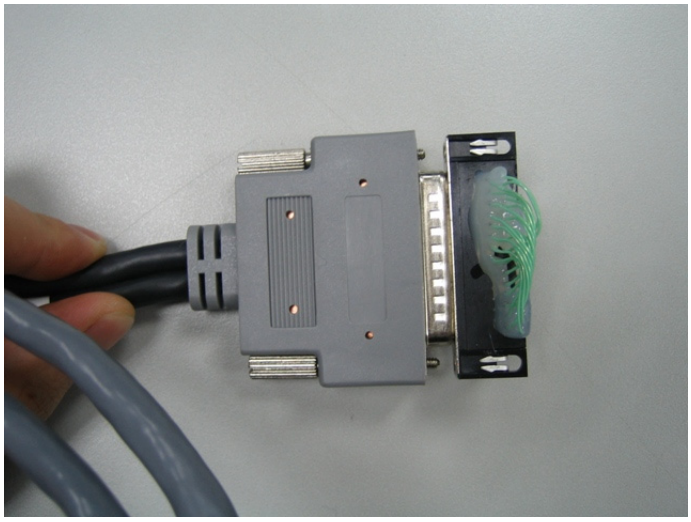
4.3 Method for Using the Loopback Connector for 120-Ohm Trunk Cables of BSC

I. Introduction to the Loopback Connector

The DB44 connector for the BSC is a special connector of Huawei. The loopback of the connector can be realized only by the loopback connector delivered by Huawei. After the loopback connector is added to the DB44 connector, all E1 channels are self looped.

II. Usage

After the loopback connector is added to the E1 DB44 connector (a Y-shaped connector having two connectors, which must be connected and tested respectively), all the E1 channels are looped back. You can use a multimeter to test the other end of the connector to determine whether all the E1 channels are conductive and whether broken circuits, crossed pairs, or cross-connected lines exist.



For example, to test the first E1 channel, you can test whether the blue wire of T1 and the blue wire of R1 are conductive and whether the white wire of T1 and the white wire of R1 are conductive with a multimeter. If they are conductive, the cable does not include broken circuits. To test whether this E1 channel has crossed pairs, you must test whether only the blue wire of T1 and the blue wire of R1 are conductive, and other wires are not conductive.

No.	Signal	TP	DB44 Pin	Color	Signal	TP	DB44 Pin	Color
1	Ring/R-	T1	15	Blue	Ring/R-	R1	38	Blue
	Tip/R+		30	White	Tip/R+		23	White