

TOSLINE-S20 Gateway TLS20GW1 User Guide

Revision: 2.2

Purpose:

This document is the User's and Installation guide for the J3077 TL-S20 Gateway. A drop-in replacement for the Toshiba ASC25. In addition, it has gateway functionality providing a means of communications between TL-S20 and the more recent TC-net 100, TC-net 1G and TC-net I/O Loop proprietary protocols to facilitate the upgrading of existing installations.

Abstract:

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2.2	RAS	HNV	Added UL and FCC Certifications	18-Apr-2023

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TABLE OF REFERENCES

- [1] UG-3298 TL-S20 USB InstallationUpdateRecovery.pdf

TABLE OF ABBREVIATIONS AND DEFINITIONS

Abbreviation	Definition
TMEIC	Toshiba Mitsubishi-Electric Industrial Systems Corporation
TMTAC	TMEIC Process Technology Application Centre Pty Ltd
TL-S20	TOSLINE-S20 Data Communication Network
ASC25	Toshiba Active Star Coupler
IEC	International Electrotechnical Commission.

1 Introduction

1.1 Purpose

This document is provided as an instruction manual and a guideline to ensure proper installation of the gateway and minimize risks of reliability issues due to incorrect connectivity of the interface. The installation team is free to use their own documentation template, but this guideline should be used as main reference.

The objective of this document is to set up the basic rule for a correct installation and usage.



An inadequate installation may lead to reliability issues.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

This procedure is an obligation for contractors to provide installation instructions to reduce possible mistakes, errors, misinterpretations, loss of time to find the correct information, etc. ..., during the software installation phase for the integration team.

1.2 Scope

This document is intended to assist the installation team to understand the connectivity of the TL-S20 Gateway and each of its components to ensure a correct installation and to help any issues during the commissioning. It will not cover detailed aspects of the design, test acceptance or validation procedures.

For further support refer to the reference documents.

System designers, device designers, and maintenance personnel using a TOSLINE-S20 network should refer to these manuals for information about how these components can be used in a TOSLINE-S20 network.

The TLS20GW1 may be configured to act as an Active Start Coupler on a Tosline-S20 network, as a drop-in replacement to the ASC25; or as a gateway where it is configured to actively participate on the Tosline-S20 network.

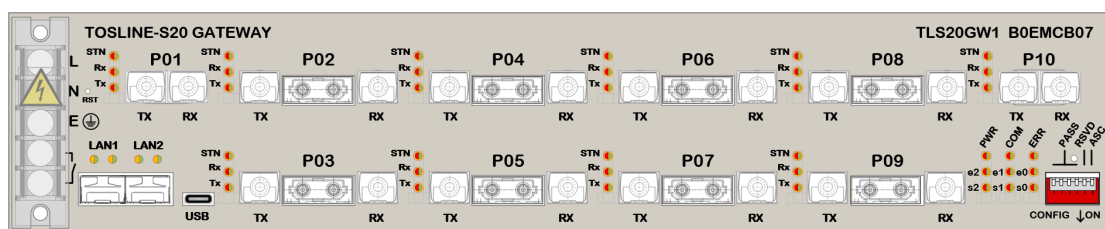


Figure 1 – Front View

2 System Configurations

2.1 ASC Basic Configuration

- Two ports are dedicated FC type connector stations
- Eight ports are either FC or F07 type connectors

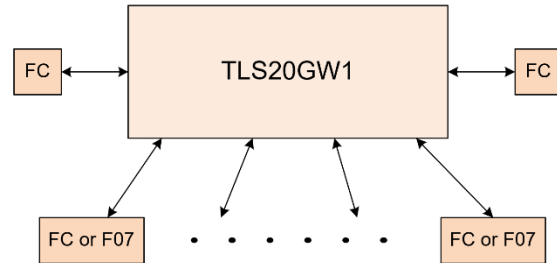


Figure 2 – ASC Basic Configuration

2.2 ASC Daisy-chain Configuration

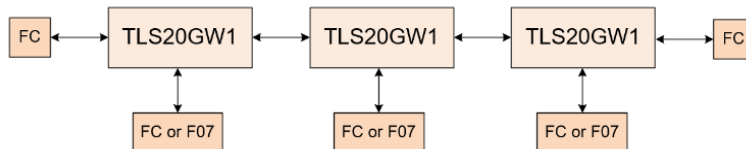


Figure 3 – Daisy-chain Configuration

The maximum number of applicable ASC25 or TLS20GW1 in the daisy-chain is nine.

2.3 Pass-through Configuration

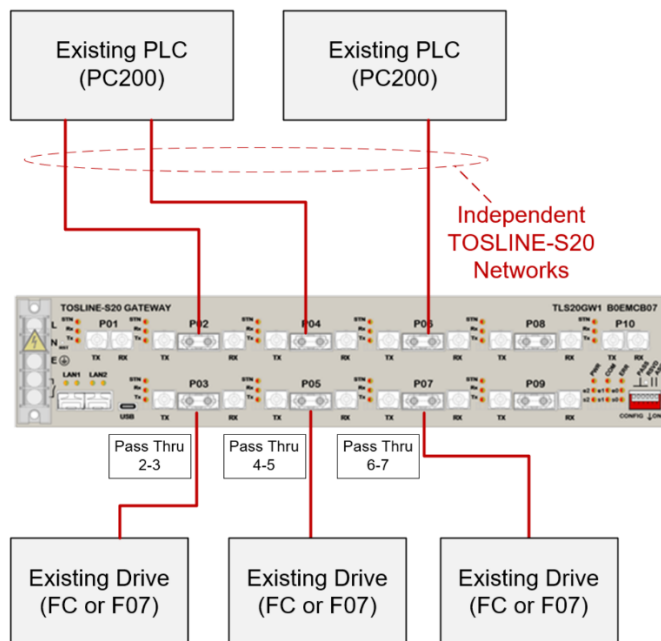


Figure 4 – Pass-through Configuration

Up to four pairs of ports can be configured as independent networks to pass-through and monitor network traffic.

2.4 Gateway Configurations

Numerous gateway configurations are possible with bridging to TC-net 100, TC-net 1G, TC-net Local Loop, OGD and EGD. Multiple networks can be supported simultaneously. More details of the gateway configuration will be provided soon. Refer to TMGW tool manual.

3 Specifications

3.1 General Specifications

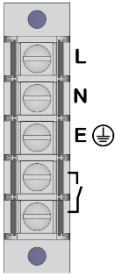
Item	Specification	
	Power Supply	Input Voltage
		Input: 100/240VAC~, 0.65/0.4A, 50/60Hz, Range: 85/265VAC~
		Power Consumption
		12W (typ. operation)
		Inrush (typ.)
		14/28A for 100/200VAC
		Hold Up Time
		20msec (typ. operation)
		Fuse Rating
		250V-2.5A Fast Blow 5x20mm Ceramic
Environment	Isolation	Input to Ground 2kVAC, Input to Output 3kVAC, Output to Ground 500VAC for 1 min.
	Overvoltage Category	OVC II – Indoor Use Only
	Mains Protection	Class I (Earthed)
	Pollution Degree Rating	Pollution Degree 2
	Protective Conductor Terminal	Protective earthing conductor is connected to the earth terminal on the front panel Terminal Block
	Temperature Operating	0 to 55°C (ambient)
	Temperature Storage	-20 to 70°C (ambient)
	Operating Humidity	30 to 90% RH non-condensing
	Vibration	10 - 55Hz (1 minute sweep), 19.6m/s ² not operating
	Shock	IEC-68-2-27, 20G (196.1m/s ²), 11ms, half sinewave
Dimensions	Atmosphere	Free from corrosive gas
	Dust Ingress Protection	To be installed in a IP5X Enclosure/Cabinet
	Moisture Protection	Use in Dry location
	Ground	< 0.5ohm
	Altitude	Up to 2000mt
		350mm (W) x 70mm (H) x 200mm (D)
		390mm (W) x 75mm (H) x 200mm (D), Shelf Mount
		482.6mm (W) x 88.05mm (H) x 200mm (D), 2U Rack
	Weight	3.25 kg
	Cooling	Fan forced, vented on rear panel with filter.
Installation Position		Horizontal only.
UL Certification		E528495
FCC Certification		FCC ID: 2A88XB0EMCB07

Table 1 – General Specifications

FCC § 15.21 Information to user

The user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

FCC §15.105 statement for Class A

For a Class A digital device or peripheral, the instructions furnished to the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC § 15.19 ((a)(3) All other devices) Labeling Statement.

All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

3.2 Operational Specifications

Item	Specification
Number of connectable stations	Max. 10
Number of independent networks	Max 8 Max 4 when configured as pass through
Optical Fiber	
for FC Type connector	OM1 62.5/125 or 50/125 um (core dia./clad dia.) Multimode Fiber Cable. Connector FC/UPC-FC/UPC Duplex. Tx wavelength nominal center 820nm
for F07 Type connector	200/230um Multimode Fiber Cable Connector F07 type CF-2071 or TOCP-200. Tx wavelength nominal center 770nm
Transmission Distance	Station to Gateway: Max. 1km Gateway to Gateway: Max. 1km Total system: Max. 10km
Number of daisy-chain	Max. 9 gateways
Connectable Apparatus	TOSLINE-S20 fiber optic network stations Gateway Industrial PC via Ethernet. SFP Gigabit Ethernet
Healthy contact (Relay contact) 	“ON” during normal operation. 1A at 30VDC – Operating resistive or inductive load. (Inductive load $\cos \phi = 0.4$, L/R = 7ms) SELV and Limited Energy (Class 2) installation only.
Tosline S20 Modes	Normal Speed (Compatible with SN322A) 64 Stations Maximum 1024 Words of scan memory per network High Speed (Compatible with SN322H) 5 Stations Maximum 128 Words of scan memory per network

Table 2 – Operational Specifications

4 Functional Descriptions

4.1 Overview

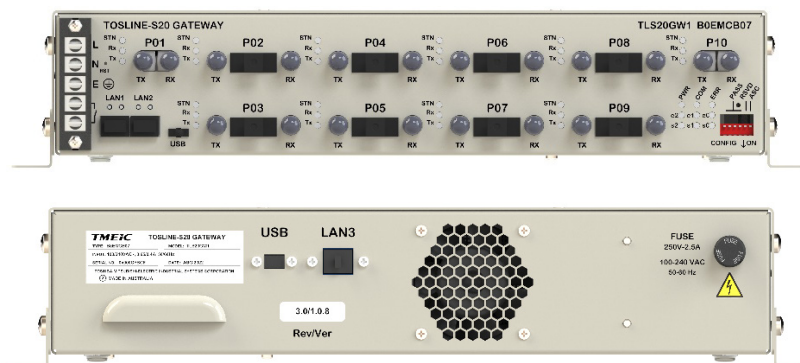
4.1.1 Construction

Mild steel 1.2mm thick enclosure. Mounting options for 19inch rack or on flat mounting frame with Side Mounting Brackets.

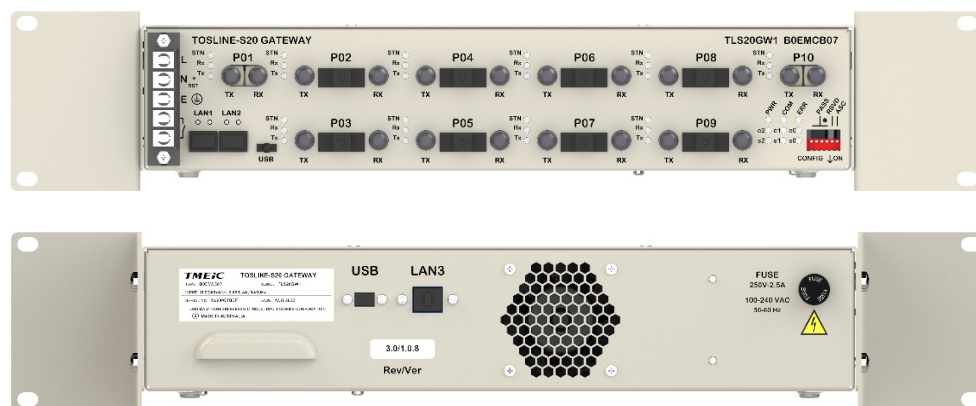
4.1.2 Dimensions

350mm (W) x 70mm (H) x 200mm (D).

390mm (W) x 75mm (H) x 200mm (D), shelf mount brackets



482.6mm (W) x 88.05mm (H) x 200mm (D), 2U Rack Mount Brackets



Note: Rear USB Port (next to LAN3) is not fitted on standard release.

4.1.3 Identification

Model name: TLS20GW1

TMEIC Part Number: B0EMCB07

Serial number and hardware revision applied to the rear panel.

4.2 LED Display

All LEDs, both system & port LEDs have a minimum 200msec operate time such that shorter state changes are stretched to be more visible. This has been tuned for Tosline S20 such that a clear-line reconfiguration period (92msec) is visible but shorter periods like solicitation windows are not.

4.2.1 Port LEDs

Each Port has 3 LEDs – Tx, Rx and STN.

For consistency with the ASC applications, the Tx LED green indicates if this port is transmitting data. The Rx LED green indicates it is receiving data.

STN 

Rx 

Tx 

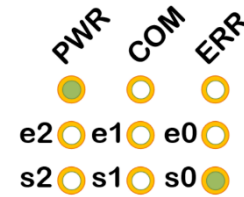
The STN LED will flash slow green to indicate Pass Through. Otherwise, the STN LED indicates the status of the internal channel associated with this port as determined by the ASC matrix configuration. Most applications will only have one channel. If there is more than one channel, only the first channel is indicated.

	TX	RX	STN
Configured as an ASC (no internal channel or offline)			
No port in the ASC group is receiving data			
This port is transmitting but not receiving			
Transmitting and receiving			
Port Connected to another port in pass through			
Neither port receiving data			 slow
Pass through OK, both Tx and Rx active			 slow
Port Connected to internal channel in STANDBY			
Not receiving data but otherwise OK			 fast
Receiving and Transmitting and OK			 fast
Channel has detected a minor error. The channel's Manchester or HDLC error counters are incrementing. Momentary stn green -> orange			 flash
Single Wire Break (Silent Mode)			 fast
Port Connected to internal channel and is ONLINE			
Channel Online, scan transmission disabled			 fast
Channel Online and transmitting scan data			
Channel has detected an error. The channel's Manchester or HDLC error counters are incrementing. Momentary stn green -> orange			
Single Wire Break (Silent Mode)			

Note the fast-flashing rate is approx. 4 flashes per second and the slow rate is one flash per second.

4.2.2 System LEDs

The group of nine LED located on the bottom right-hand corner of the front panel indicate the overall status of the gateway.



The image shown is typical of ASC mode:

Overall System Status	PWR	COM	ERR
Power On – Before processor has started / FPGA configured			
Normal Operation – processor has started			
Bootling – the COM LED flashes fast green			
Normal Operation – upstream comms established (1)			
Error LEDs	e2	e1	e0
No system error			
Boot progress – see section 4.2.3 (one or more green)	or	or	or
System Operating Mode LEDs	s2	s1	s0
ASC Mode			
Optical Test Mode (2)			
Gateway Mode			

Notes:

(1) The COM LED is for upstream communications to the Gateway PC. This is solid green if there is a gateway application/configuration running that requires upstream comms and upstream comms is established. If upstream comms is lost then the COM LED is turned off.

(2) After 8.5 minutes the optical outputs are turned off and s1 becomes orange to protect the drivers

4.2.3 Gateway Start-up Sequence

The normal gateway start-up sequence is:

Start-up Sequence	LEDs		
1. Power on	PWR	COM	ERR
2. Zynq Booting	PWR	COM	ERR
3. LED test Confirms the FPGA is programmed.	Status LEDs flash orange Then Port LEDs flash orange twice each		
4. Boot progress	Boot time is approx. 50 sec. PWR COM ERR		
	e2	e1	e0
First stage boot			
u-boot			
Linux boot			
Application Extract			
Application Starting			
tlxd running			

Notes:

1. The COM LED flashed rapidly while booting progresses
2. The Linux boot LEDs will be green if booting from eMMC, else orange.
3. Application extract only occurs when booting from eMMC.
4. The startup LED sequence is not fully implemented. U-boot to Application Starting steps are not animated yet. TLXD does turn off the flashing COM LED.
5. If a fatal error occurs during startup and it can't proceed, the corresponding error LEDs will flash red.

Following this the application takes control of the LEDs.

4.2.4 Recovery Sequence

The recovery sequence may be used to perform a Software/Firmware upgrade. A recovery image will be provided and loaded on to a USB-C memory stick with a FAT32 file system.

To initiate recovery mode, insert a USB stick with recovery image, then power on while holding the front panel “RST” button on (Figure 5 and Figure 6). Continue holding the RST button until the front panel leds display the following sequence:

1. The s1-3, e1-3, Com and ERR leds will flash orange twice.
2. The STN, Tx and Rx leds will flash orange twice.
3. The COMM and ERR leds will start flashing out of phase.

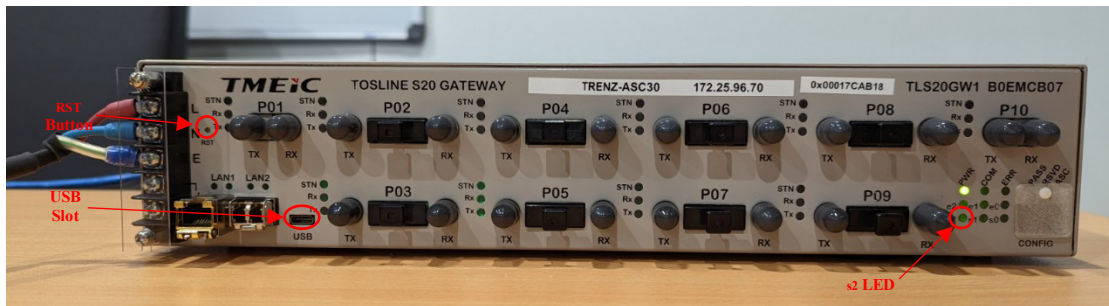


Figure 5 – RST button and USB interface



Figure 6 – Powering up in recovery mode

Alternatively, if a gateway is already powered on and running, a recovery mode may be initiated by pressing and holding the RST button as follows:

4. After holding for 5 seconds, the s2 LED will start flashing orange
5. If the RST button is then released, a hardware reset will occur (no USB required)
6. Keep holding the RST button for a further 5 seconds and when the unit reboots it will be in recovery mode. You can then release the RST button.



Figure 7 – Change from normal to recovery mode

Recovery Sequence	LEDs
1. Power on	PWR = Orange
2. Zynq Booting	PWR = Green
3. LED test Confirms the FPGA is programmed.	Status LEDs flash orange Then Port LEDs flash orange twice each
4. Recovery Indication	COM Flash.Green ERR Flash.Orange (alternating)
5. Update script starts	s2 s1 s0 all Flash Green slow
6. Image Verify	s2 s1 s0 all Flash Green fast
7a. Update Successful	e2 e1 e0 s2 s1 s0 Green
7b. Update failed	e2 e1 e0 all Flash Red s2 s1 s0 all Flash Red

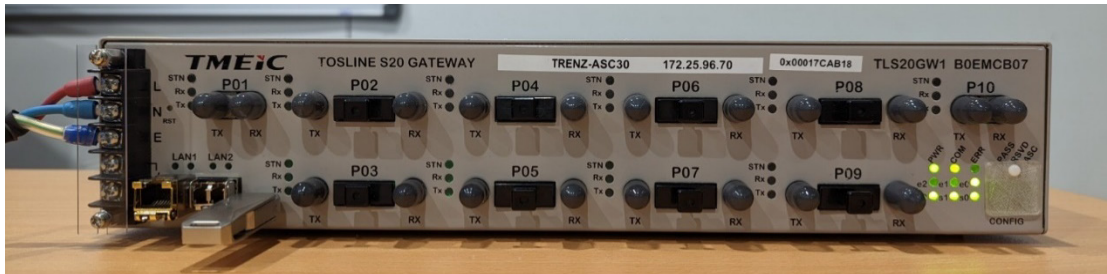
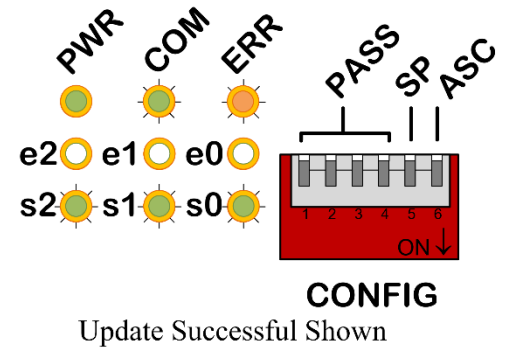


Figure 8 – Successful Update

Once the recovery is complete, remove the USB and power cycle to restart.

For more comprehensive information about recovery operations please refer to [1].

4.2.5 Ethernet LEDs

The two Ethernet SFP modules each have two status LEDs which indicate interface status. These are both off if the interface down/unconfigured, otherwise are set as shown in table 3.

Table 3 – Ethernet Interface Status LEDs

Left LED – SFP Status		Right LED – Communications Status	
Off	SFP absent or Los of Signal	Off	SFP absent or Loss of Signal, or no communication in 30 sec
Yellow Flash	Hardware Error (SFP status cannot be read)	Yellow Flash	Comms error in last 2 sec SFP laser fault reported Interface not found
		Green Flash	Communication in last 2 sec
Green	SFP Present and Signal Present	Green	Communication in last 30 sec

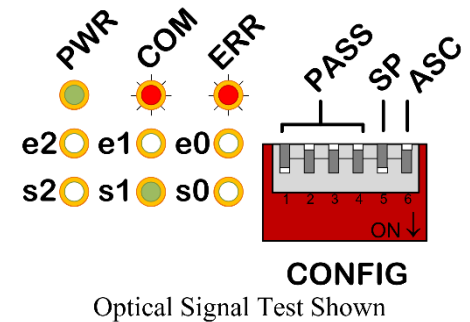
Note that Loss of Signal status is not reported by many copper SFP modules, in which case removal of network cable will not affect the SFP status led.

4.3 Configuration

4.3.1 DIP Switch

The mode selected using the DIP Switch is latched at power-up and remains active until the next power cycle. To change this mode: turn the power-off, select DIP switch, power-up.

Stand-alone Modes	DIP 1-6 (0=Off, 1=On)	Note
ASC Mode	000001	PWR Green S0 Green
Test Modes:	100010	COM Flash.Red ERR Flash.Red s2=Off, s1=Green, s0 Off s2=Off, s1=Orange, s0 Off
Optical signal test (active or 8.5min) Optical finished		
Pass through	XXXX0X	PWR Green STN LED slow flash Green
Gateway Mode	000000	PWR Green Other LEDs controlled by the application config



Note “X” in Pass through indicates the switch may be ON or OFF. The respective Rx LEDs on both associated ports indicates pass through is active. DIP Sw1 corresponds to Ports 2-3, Sw2 to Ports 4-5 etc. The ASC switch may also be ON and will route traffic between any ports not in pass through on a separate network.

4.4 Optical Connectors

4.4.1 Optical Cables

For the transmission cables of the Gateway, the optical fibre cables are used.

- Position and name of optical connector:
The Gateway has ten optical connector connection ports, Port 1 through Port10. They are positioned on the front panel of the unit: All ports are FC Type connectors, and Port 2 through Port 9 also have F07 Type connectors.
- Connection cable, see 3.2 Operational Specifications
 - for FC Type: (Port 1 through Port 10)
 - for F07 Type: (Port 2 through Port 9)
- Connection of cables
Connection is made between FC Type connector and FC Type connector, and between F07 Type connector and F07 Type connector.
For more detail, refer to Section 6.

4.4.2 Port Blocking

Ports 2 to 9 are fitted with both FC and F07 type connectors. Priority Selection Logic has been implemented to automatically detect and select the active connector on each port.

- On each separate input (FC and F07) a "valid burst detection" module looks for correctly encoded Manchester data. It must see 4 consecutive valid bits before propagating.
- A valid burst for ~100 bits cause the port to become the Active Port. This leads to the other port being blocked.
- A clear line or invalid period (active high or low) of 200msec causes the priority selection to be reset.

Detecting the active port and blocking the other port helps prevent optical interference if the caps left off. However, it is recommended to replace caps on any unused port.

Ports 1 and 10 are FC only and typically used for daisy-chaining boxes. Since all ports have no priority among them, arbitrarily any port may be used. Therefore Port 2 through Port 9 can establish the daisy-chain connection between Gateways without raising functional problems.

Note: single wire breaking protection has not been implemented on the TLS20GW1 gateway.

4.5 Ethernet Interfaces

Three Ethernet interfaces are provided. Two front panel ports are SFP and support 1Gbps only. The rear port is RJ45 (copper ethernet) and supports 10/100/Gigabit.

The two front panel ports - Lan 1 (SFP0) and Lan 2(SFP1) are open ports for optical or copper connectivity.

Recommended UL approved part list. Applicable UL categories are NWGQ2/8 or AZOT2/8.

The Ethernet ports are required for:

- Gateway operations
- Remote Configuration
- ODG and EGD connections

These ports are not needed for ASC or Pass-through Modes.



The unit is to be connected only to internal Ethernet networks without exiting a facility and being subjected to TNVs.

The Ethernet connections are only intended for connection to Local Area Networks (LANs) and must not be connected to telephone networks or telecommunication lines.



SFP Transceivers are tested compliant with Class 1 Laser.

Do not look directly at the light emitting device.

4.6 Terminal Block Interface

4.6.1 Mains

Nominal 100-240VAC

L = Live or Active

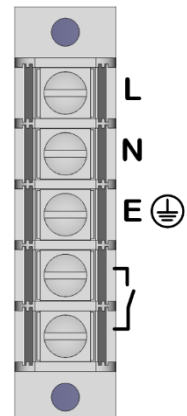
N = Neutral

E = Earth or Ground.

4.6.2 Healthy Contact (Alarm)

This is a dry relay contact. Healthy contract indicates abnormal state of power source or communication.

Healthy Contact	Condition
Closed	Power supply is normal, and any one of the 10 ports is in normal operation
Open	Power source if OFF or no port is connected. An interruption in Tosline S20 communications for more than 250msec will cause the relay to open.



Load:

“ON” during normal operation

1A at 30VDC Operating resistive or inductive load
(Inductive load $\cos \phi = 0.4$, L/R = 7ms)

SELV and Limited Energy (Class 2) installation only.

4.7 Fuse

The fuse holder is located on the rear panel. This is for a 5x20mm 2.5A fuse, fast blow, ceramic type. When power source is connected, and the POWER lamp of LED is not turned ON, fuse may be blown. In that case, cut OFF the power supply, and replace the fuse in the fuse holder at rear panel of the Gateway. Then turn the power source switch to "ON" position, again.

5 Start-up and Power Down

5.1 Start-up Method

1. Connect power supply cables to individual stations which are connected to the Gateway.
2. Connect the connecting station with the Gateway, or with another Gateway (in the case of daisy-chain connection), using respective transmission cables.
3. Set the operational mode DIP switch (before power is turned on).
4. Supply power to the Gateway and to each station.
(Note) Any Gateway or station may be started first.
5. Begin the transmission to each station. (Refer to the instruction manual for respective stations.)

Repeat these steps, for each Gateway

5.2 Power Down Method

Cut off the power supply to the Gateway and to each station.

(Note) Any station or Gateway may be cut off first.

6 Installation Instructions

6.1 Precautions

Important Safety Instructions

Read these instructions carefully. Become familiar with the instructions before trying to install, operate, service or maintain this equipment.

The following safety messages and symbols may appear throughout the instruction manuals or on the equipment to warn of potential hazards. Read the information that clarifies or simplifies the installation and operation procedure.

	High Voltage Present. This symbol indicated "Danger" or "Warning". This safety message indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed. Do not open this equipment. To be serviced by qualified electrician only.
	General Warning. The addition of this symbol to a "Caution" safety message indicates potential safety hazard which will result in personal injury if the instructions are not followed.
	ESD Sensitive Apparatus. Do not open this equipment. To be serviced by qualified personnel with electrostatic protective gear.

6.2 Wiring Recommendations

6.2.1 Mains Supply



This equipment must be permanently connected to a nominal 100V to 240VAC Mains Supply.
Do not connect this equipment outside the minimum and maximum specified limits.

6.2.1.1 Input Power Rating:

Input Voltage: 100V-240VAC~ nominal
Range: 85-265VAC~, 0.65/0.4A, 50-60Hz
Fuse: 2.5A @250VAC, Ceramic, fast blow action.

6.2.2 ON-OFF Switch:



ON-OFF switch is not supported on this equipment.
Switch operation must be implemented externally.

Recommendation:

This equipment must be installed on a Circuit Breaker Mains Installation.

6.2.2.1 Terminal Block:

	L	LINE	Live Wire from Mains Supply.	
	N	NEUTRAL	Neutral wire from Mains Supply.	
	E	EARTH	This Equipment must be Earthed. Class I Mains Protection.	
	AL	Alarm	Relay Dry Contact Operation 24VDC Circuit SELV and Limited Energy (Class 2) installation only Protection Level OVC II, 250VAC	
	AL	Alarm		
	Terminal Rating		UL, CSA Class B Wire Size Range Temperature Phillip Head Torque	300VAC 14-22 AWG -40 to +100C Operating PH2 1.4 N-m
	Ring Terminal Molex p/n: 19070-0040 Or similar		Stud Size #6 (M3-3.5) Wire Insulation Diameter = 0.146" (3.71mm) Wire Size = AWG 18, 20, 22. Ring OD Diameter = 0.264" (6.7mm) Pitch between centre = 9.53mm	
	Field Wiring Terminal Marking		Use Copper Conductors Only	

6.2.2.2 Field Wiring Temperature Rating

Under the maximum ambient temperature operation of 55C of the TLS20GW1 equipment, the internal housing temperature may raise over 60C but will not exceed 70C maximum.

The terminal block will operate over 60C, and the electrical wiring must comply with the temperature rating.



Warning!

Check power cable data sheet for Temperature Rating and Voltage Rating
Recommended high temperature, flame retardant wire.

Follow Installation Manual and Safety Guidelines.

See section 4.1.2 for front view details.

6.3 Service

This equipment cannot be serviced on site. It must be returned to the Manufacturer.



Warning!

An inadequate installation may lead to safety and reliability issues.
This equipment is connected to mains supply (100-240V)

Follow Installation Manual and Safety Guidelines.

6.4 Environment



The TLS20GW1 equipment must be installed in an IP5X rated cabinet in a dry environment.
Dust protection covers must be fitted on all unused ports.

6.5 Additional Precautions

It is recommended that no connections or disconnection of cables be performed whilst the system is in production.