



# **Watson 5 Ethernet**

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## **Operating Manual**

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# Declaration of Conformity

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## Tabletop

W5 tabletop Ethernet, single link 1p

SZ.846.V350

W5 tabletop Ethernet, single link 2p

SZ.846.V450

## Plugin

W5 plugin, 4 x Ethernet, 4 x DSL

SZ.866.V654

## Manufacturer:

Schmid Telecom AG, Binzstrasse 35, CH-8045 Zurich

The products mentioned above comply with the regulations of the following European Directives:

### 89/336/EEC

Directive containing requirements regarding electro-magnetic compatibility.

The compliance of the above mentioned product with the requirements of the directive 89/336/EEC is ensured by complete application of the following harmonized European Standards:

EN 300386:2000

### 73/23/EEC

Directive containing requirements regarding safety.

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EN 60950:2000 (IEC 60950:1999)

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EN 55022:1998, EN 55024:1998

EN 60950:2000 (IEC 60950:1999)

The compliance of the above mentioned products with the specified requirements of the applicable directives and harmonized and non-harmonized standards is shown in the following internal and external test reports:

- W5A Safety Report.pdf
- W5B LTU 4xEth 4xDSL Protection Report 0.1.doc
- W5B NTU Ethernet EMC Report.1.doc
- W5B NTU Ethernet Environmental external test Report.1.pdf
- W5B NTU Ethernet EMC external test Report.1.pdf

**CE Label attached to the product(s):**

on tabletop, for plugin on minirack and on 19" subrack

**Issued by:**

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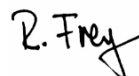
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- This product is to be used with telecommunications circuits. Take the following precautions:
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  - Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
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- [1] Schmid Telecom, *Watson 5 Users Manual*
- [2] Schmid Telecom, *Watson 5 Ethernet Quick Guide*
- [3] Schmid Telecom, *WEM-2 Users Manual*
- [4] Schmid Telecom, *Watson Rack Operating Manual*
- [5] Schmid Telecom, *Watson Minirack Mechanics Operating Manual*
- [6] Schmid Telecom, *Watson Tabletop Housing for Plugin Manual*
- [7] Schmid Telecom, *Flashloader Operating Manual*
- [8] ETSI TS 101 524, 2004
- [9] EN 30059





## 2.1 Introduction

The Watson 5 Ethernet modems are SHDSL transmission systems compliant to ITU-T G.991.2 Annex B (G.SHDSL.bis) and to ETSI TS 101 524 (ETSI eSDSL).

SHDSL uses Trellis-coded PAM-16 and PAM-32 linecodes supporting multiple line rates as well as 1-pair, 2-pair and 4-pair DSL transmission.

The Watson 5 Ethernet modems are available as plugin cards and as tabletop units. Both plugin cards and tabletops can work as DSL master modems (STU-C) and as DSL slave modems (STU-R).

The modems can be configured with an RS-232 terminal through a commandline interface (Monitor).

For remote management a Telnet access to the Monitor is available. The plugin modems also have an SNMP agent integrated. One agent can control all plugin modems in a subrack and all tabletop modems connected to the subrack modems.

## 2.2 Applications

Figure 2-1 shows deployment of Watson 5 Ethernet to deliver Point – to – Multipoint Ethernet Services:

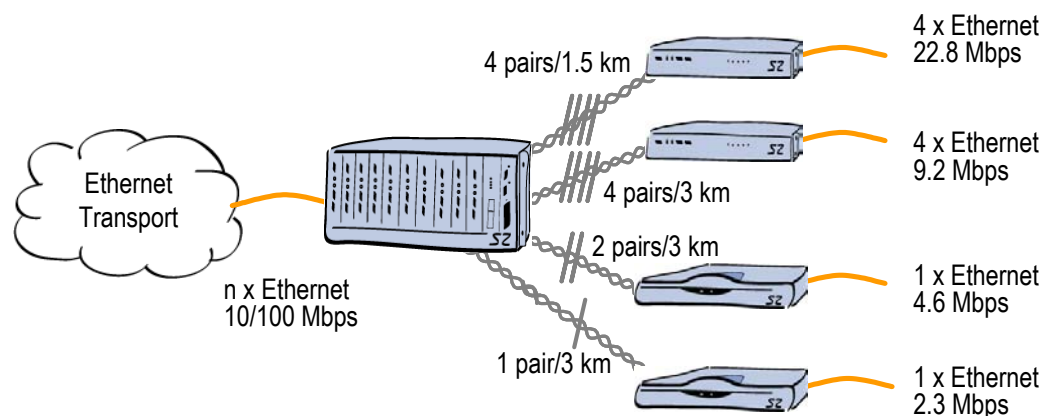


Figure 2-1: Point-Multipoint Ethernet Services

Several Ethernet plugin cards are installed in a subrack at the central office or the point of presence. Depending on the service offered each plugin can serve between one and four customers. At the customer premises either a tabletop modem (for line rates up to 4.6 Mbps) or a plugin card in a

tabletop housing (for linerates up to 22.8 Mbps) is installed. Traffic from each customer is available at a dedicated Ethernet interface in the central office. Alternatively traffic from several customers can be aggregated to a single Ethernet port. Advanced VLAN functions allow for customer isolation and traffic management.

Watson 5 Ethernet modems can also be deployed back-to-back as shown in Figure 2-2:

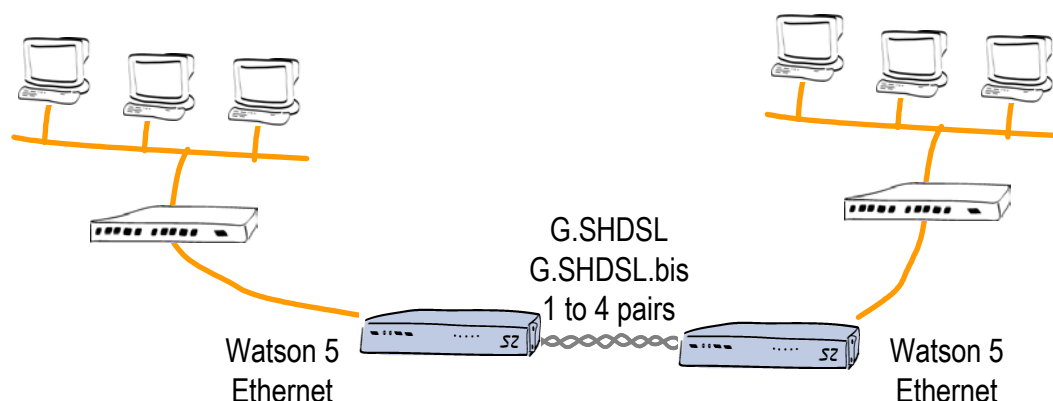


Figure 2-2: Campus Networks

For these applications either two tabletop modems or two plugin modems (in an appropriate housing) are connected back to back with one of the modems being configured as DSL master and the other one as DSL slave. Depending on the distance and the number of wire pairs available linerates up to 22.8 MBit/s are available. VLAN and MAC Address filtering functions allow for traffic management and optimal use of the available DSL bandwidth.

Deployment in linear networks is supported with the Watson 5 Ethernet plugin card:

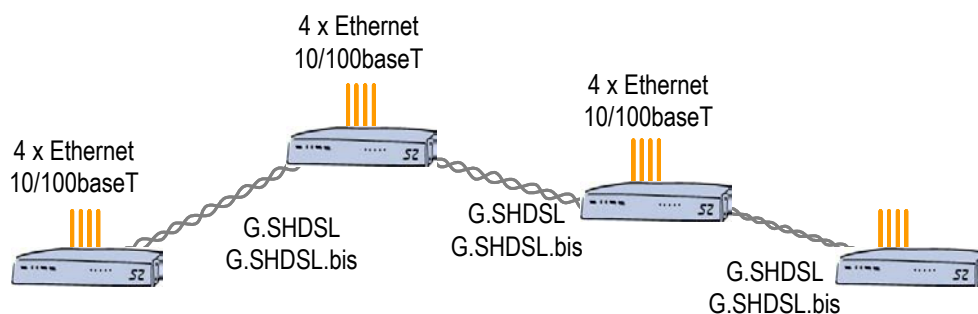


Figure 2-3: Linear Ethernet Network

In Figure 2-3 several sites (e.g. stations along a pipeline or a power line) are connected with single or two pair DSL systems. In each site a single Watson 5 Ethernet plugin card terminates the DSL links coming from "East" and "West" sides and gives four local Ethernet interfaces e.g. to connect local station control equipment. Traffic from the local interfaces can be aggregated with traffic on the DSL and can be sent to either direction along the line. Traffic streams are kept separate through VLANs, and Class of Service/Priority functions allow for traffic management.

The entire chain can be managed from a centralized site through inband management.

The Watson 5 Ethernet tabletop modems can also be used together with TDM-based Watson 5 modems with E1 or nx64 user interfaces to transport Ethernet packets over Wide Area Networks:

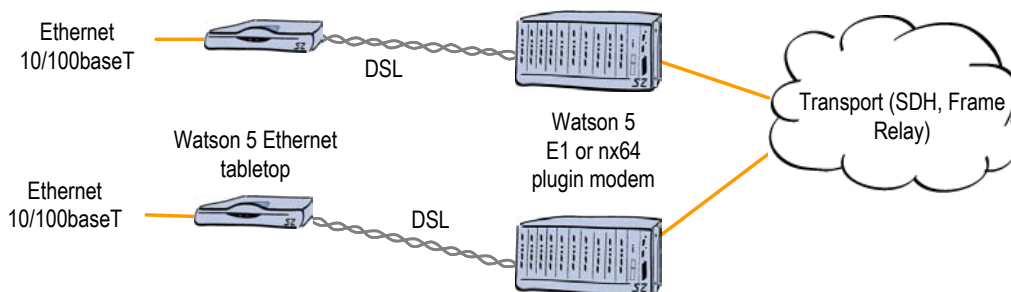


Figure 2-4: Ethernet over WAN

Here a Watson 5 Ethernet tabletop modems are installed at the customer premises and Watson 5 TDM modems in the central office. Ethernet packets are transported transparently from one Watson 5 Ethernet modem to the other. No intermediate protocol conversion (e.g. ATM) is required to map Ethernet to the E1/SDH or Frame Relay WAN. Instead of establishing a connection between two Watson 5 Ethernet tabletop modems the connection can also be terminated in the WAN port of a router supporting the Cisco HDLC protocol.

## 2.3 Modem Types

The following Watson 5 Ethernet modems are available:

Description	Order Code
W5 plugin 4 x Ethernet, 4 x DSL	SZ.866.V654W
W5 tabletop Ethernet, single link 1p	SZ.846.V350W
W5 tabletop Ethernet, single link 2p	SZ.846.V450W

Table 2-1: Watson 5 Ethernet modem types

## 2.4 Accessories

The following accessories for the Watson 5 Ethernet modems are available:

### 2.4.1 Accessories for plugin

Description	Order Code
19" Subrack for WATSON HDSL (for 12 plugin + 1 ACU/CMU)	SZ.379.V3W
Alarm Control Unit (2 Relays) with ext. Clock, for 19" Subrack	SZ.369.V5W
19" Minirack Mechanics for Plug In 2xDC Power	SZ.876.V110W
19" Minirack Mechanics for Plug In AC & 2xDC Power	SZ.876.V100W
Tabletop Housing for Watson Plugin DC Powering	SZ.875.V100W
Tabletop housing for Watson Plug In AC + DC Power	SZ.875.V110W

Table 2-2: Accessories for tabletop

## 2.4.2 Accessories for tabletop

Description	Order Code
AC/DC Adapter 100-240 VAC, 48 VDC, 15W AC Euro Plug.	SZ.410.080.V1E
19" Minirack Mechanics for Table Top tabletop	SZ.896.V100W

Table 2-3: Accessories for tabletop

## 3

## Modem Features

### 3.1 DSL

#### 3.1.1 Linerates and DSL sync rates

Watson 5 Ethernet supports SDSL as specified in ETSI TS 101 524 and ITU-T G.991.2. The linecode used is TC-PAM 16, the maximum linerate rate per pair is 2'306 kbit/s (36 timeslots with 64 kbit/s each).

The Watson 5 Ethernet plugin can be configured for the 2004 revision of ETSI TS 101 524, also known as eSDSL (ETSI) or G.SHDSL.bis (ITU-T). G.SHDSL.bis allows for higher symbol rates and a 32-level linecode (TC-PAM 32). The maximum number of timeslots per pair in G.SHDSL.bis is 89, the maximum linerate rate per pair is 5'696 kbit/s.

There is some overlap between the linerates attainable in G.SHDSL and G.SHDSL.bis, cf. Figure 3-1:

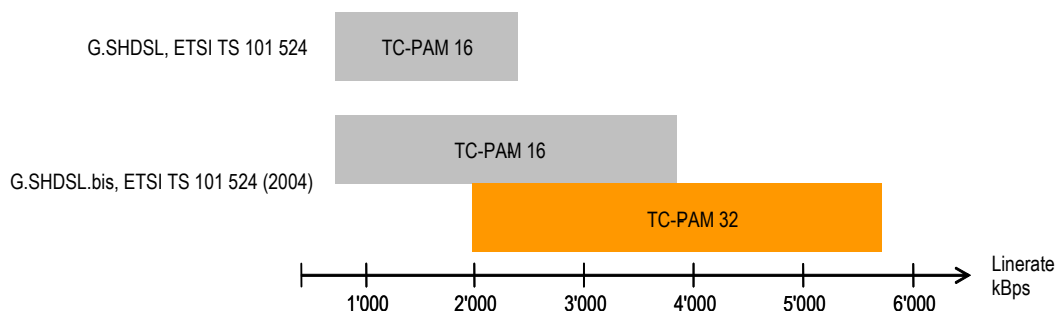


Figure 3-1: G.SHDSL and G.SHDSL.bis linerates

This means that for certain linerates either TC-PAM 16 or TC-PAM 32 can be configured in the modem. TC-PAM 16 has the better DSL performance than TC-PAM 32. However with linerates rates higher than 2.3 MBit/s (36 timeslots) and TC-PAM 16 the symbol rate over the DSL becomes higher than what was specified in the original version of TS 101 524. Higher symbol rates mean wider PSDs which in turn can lead to higher interference to other DSL systems in the same cable binder, e.g. ADSL, ADSL2, ADSL2+.

The linerate rate, i.e. the data rate available to the application is calculated as follows:

$$\text{Linerate} = m \times n \times 64 \quad [\text{kbit} / \text{s}]$$

$$m = \text{number of wire pairs (1} \dots 4)$$

$$n = \text{number of timeslots per pair (3} \dots 89)$$

Note:  $n = 3 \dots 36$  for the Watson 5 Ethernet tabletop modem

The physical DSL synchronization rate per pair is

$$\text{Syncrate} = n \times 64 + OH \quad [\text{kbit} / \text{s}]$$

$n$  = number of timeslots (3...89)

$OH$  = SHDSL Overhead (8 kbit / s including 3.2 kbit / s EOC)

Note:  $n = 3 \dots 36$  for the Watson 5 Ethernet tabletop modem

The sync rate determines the DSL reach. Decreasing the sync rate increases DSL reach and vice versa. The linerate rate has no influence on the DSL reach.

### 3.1.2 Multipair operation

Watson 5 Ethernet modems support multipair operation (m-wire mode). This allows for bandwidth aggregation of individual DSL wire pairs for higher speeds or increased reach at a given speed.

A multipair DSL link is called a span. Each wire pair of a span must be configured with the same linerate. If one pair of an m-wire span fails then the entire span must be restarted.

The following naming conventions are used in multipair operation on the Watson 5 Ethernet plugin:

- DSL spans are named DSL1, DSL2, DSL3 and DSL4. A span can consist of one or several wire pairs. The number of DSL spans available on a plugin depends on the plugin configuration (Monitor command `CARDMODE`).
- Wire pairs within a span are named A, B, C and D. Depending on the number of wire pairs within a span the wire pairs B, C or D might not exist.
- Physical wire pairs available at the plugin DSL connector are named a, b, c and d.

Depending of the operation mode of the Watson 5 Ethernet plugin (which is set by the Monitor command `CARDMODE`, cf. 7.1.1) the following combinations are possible:

CARDMODE	Spans	Wire pairs	Connection Points
1	DSL1	A	a1, a2
	DSL2	A	b1, b2
	DSL3	A	c1, c2
	DSL4	A	d1, d2
2	DSL1	A, B	a1, a2, b1, b2
	DSL3	A, B	c1, c2, d1, d2
3	DSL1	A, B	a1, a2, b1, b2
	DSL3	A	c1, c2
	DSL4	A	d1, d2
4	DSL1	A, B, C, D	a1, a2, b1, b2 c1, c2, d1, d2

Table 3-1: Naming of DSL spans, pairs and connection points

### 3.1.3 Power Backoff

The transmit power of the modems can be decreased by activating the power back-off mode. This reduces interference to other transmission systems operating on adjacent pairs bundled in the same cable.

With enabled power back-off the transmit power will be reduced adaptively in function of the estimated cable attenuation:

Estimated Power Loss(*)	Power Backoff
< 1 dB	6 dB
< 2 dB	5 dB
< 3 dB	4 dB
< 4 dB	3 dB
< 5 dB	2 dB
< 6 dB	1 dB
≥ 6 dB	no backoff
(*) Calculated as Tx Power – Estimated Rx Power	

Table 3-2: Power Backoff

*Note:* Power backoff can be configured individually for plugin and tabletop.

### 3.1.4 Symmetric and Asymmetric PSDs

The Watson 5 Ethernet tabletop modems support asymmetric PSDs for linerates of 2'056 kbit/s and 2'312 kbit/s.

Activating asymmetrical PSD masks will increase upstream transmit power (STU-R → STU-C). This improves near-end crosstalk (NEXT) at the STU-C side and will increase the possible loop length in cases where many DSL links have to share the same cable e.g. coming out of a central office.

*Note:* The Watson 5 Ethernet plugin does not support asymmetric PSDs.

### 3.1.5 DSL Performance

The Watson 5 Ethernet modems provide information about the current Signal Quality and Attenuation of a DSL link.

#### Signal Quality

The Signal Quality is the noise margin calculated by the modem:

$$SQ = SNR1 - SNR0$$

Where

- $SQ$  is the calculated noise margin
- $SNR1$  is the signal to noise ratio calculated by the transceiver by analyzing the error correction bits (Trellis bits) in the line code.
- $SNR0$  is the signal to noise ratio that gives a bit error rate of  $10^{-7}$  in presence of average white Gaussian noise. For TC-PAM16 the theoretical value for  $SNR0$  is 27.7 dB.

### Attenuation

The link attenuation is calculated by the modem assuming 0.4mm PE cable without bridged taps and measured at 150 kHz (for line rates of 200 kbit/s up to 1'992 kbit/s) or 200 kHz (for line rates of 2'056 kbit/s and above). This calculated attenuation may differ from the attenuation measured by other equipment for other cable configurations (other cable diameter, splices, bridged taps).

Both Signal Quality and Attenuation are effective maintenance tools for determining inadequate or bad cable pairs. They are available with the `DIAGNOSTIC Monitor` command.

### 3.1.6 Wetting Current

The Watson 5 Ethernet plugin can source or sink wetting current over the DSL line. Wetting current is configured per wire pair by jumpers located on the lower left corner of the plugin:

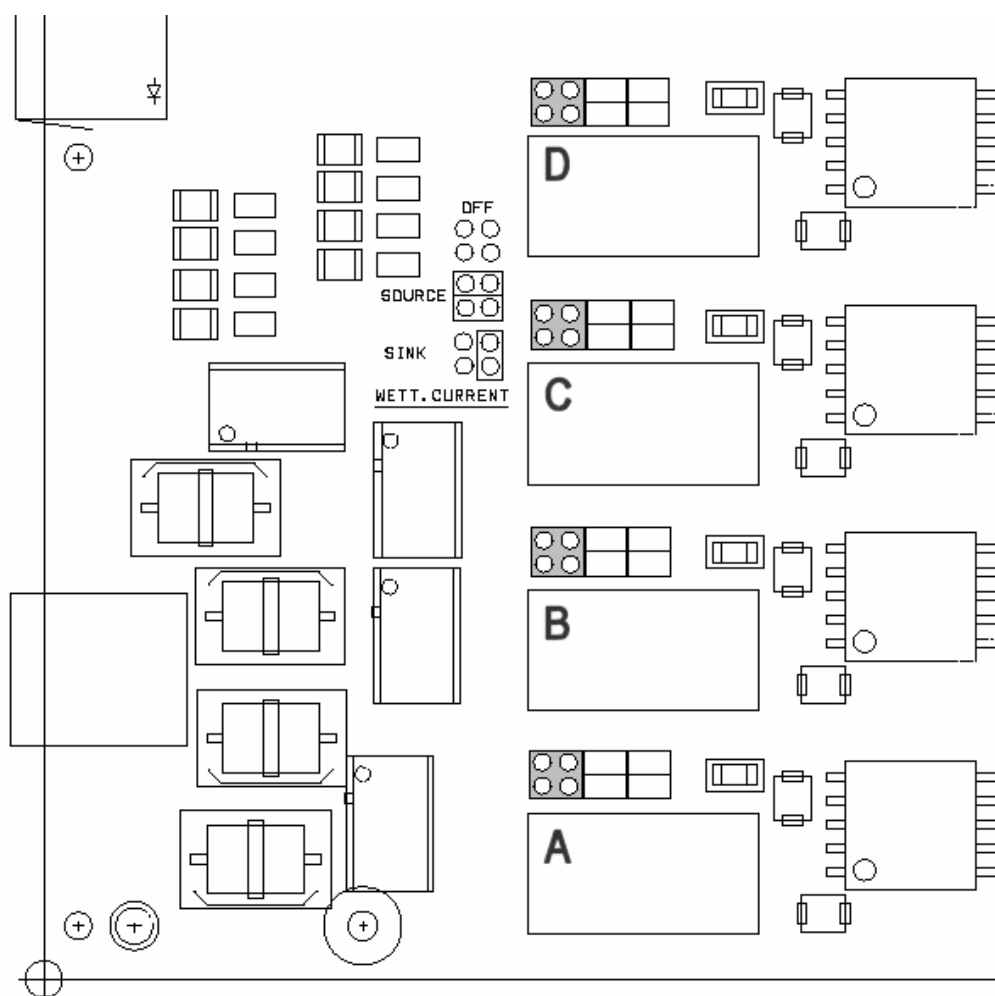


Figure 3-2: Wetting current jumper location






Jumper Configuration	Wetting Current Function
 (no jumpers)	Wetting current off
 (two jumpers)	Wetting current source
 (one jumper)	Wetting current sink

Table 3-3: Wetting current jumper settings

The Watson 5 Ethernet tabletop modems cannot source wetting current. It will always sink wetting current when local powering is used.

### 3.1.7 Master / Slave

To start up a DSL link, one system unit must be configured as master modem (STU-C) and the other one as slave (STU-R). The master controls the link startup procedure. If both system units are configured as master or as slave, no startup will occur.

Usually, the plugin is configured as master and the tabletop modem as slave (default setting). However, it is possible to set up a DSL link with two plugins or two tabletops, as long as one is configured as master and the other one as slave.

### 3.1.8 DSL Clocking

Watson 5 Ethernet modems have a crystal controlled DSL clock that does not depend on the clocking of the Ethernet user interfaces (clockmode 1 of TS 101 524).

## 3.2 Ethernet (plugin modem)

### 3.2.1 Ethernet over DSL

Ethernet packets are mapped on the DSL frame using the packet mode TPS-TC layer of ETSI TS 101 524. The modems use bit stuffing to improve efficiency.

The Ethernet MAC-frames are reformatted before being transmitted over the DSL link:

- Preamble (PRE), Start-of-Frame delimiter (SFD) and PAD fields are stripped off
- The Ethernet CRC-32 is replaced by a CRC-16 calculated over all fields of the MAC frame

PRE, SFD, an eventual PAD and the CRC-32 are reconstructed by the receiving modem before transmitting the MAC frame over its Ethernet interface.

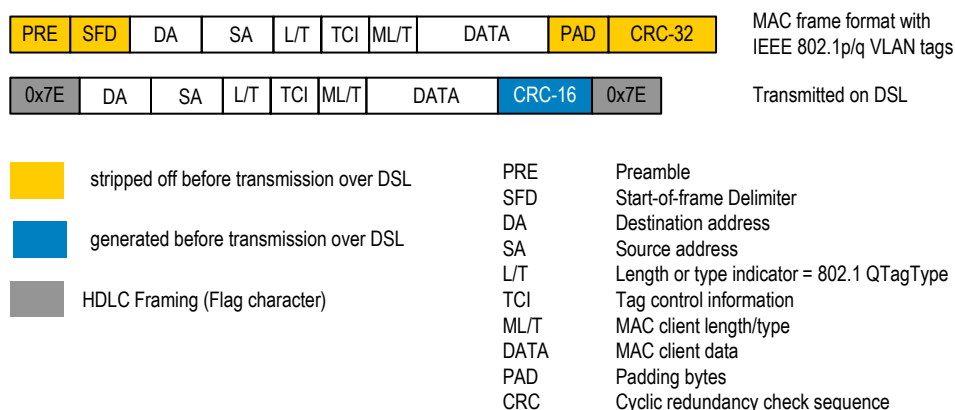


Figure 3-3: Ethernet over DSL

### 3.2.2 Ethernet Bridging

The Watson 5 Ethernet plugin card has a built-in Ethernet bridge that connects Ethernet ports, DSL ports and the plugin controller:

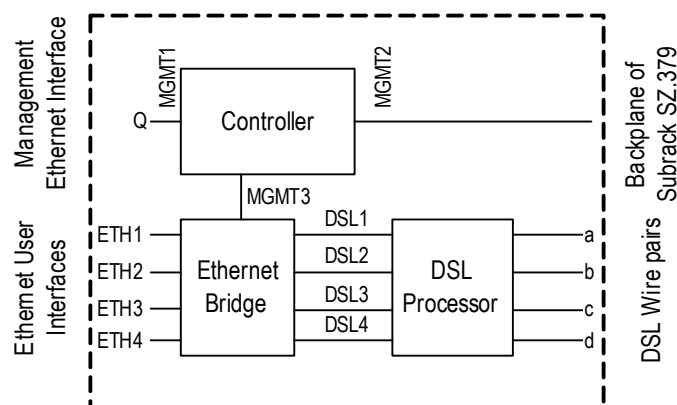


Figure 3-4: Watson 5 Ethernet plugin Block diagram

The Ethernet bridge supports the following modes

- 1) VLAN bridging. Layer 2 VLANs are used to control the traffic. For an Ethernet packet to be sent from one port to another both ports must be configured to be in the same VLAN. This bridging mode allows to connect Ethernet user interfaces can be switched to DSL interfaces and vice versa. It is also possible to switch packets from several DSL interfaces to one Ethernet interface (concentration), to switch packets from an Ethernet or DSL interface to the Management Processor interface MGMT3 (used for inband management) or to switch packets from DSL to DSL interface.
- 2) Transparent bridging. In this mode there is a fixed association between DSL and Ethernet bridge ports:

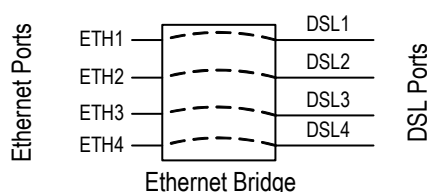


Figure 3-5: Transparent bridging

Transparent bridging is similar to the VLAN transparency provided by the Watson 5 Ethernet tabletop modem, cf. 3.3.2. Transparent bridging lacks the flexibility of VLAN bridging, and in-band management or linear networks are not supported in this mode. The advantage of transparent bridging is that it is not required to configure any VLAN tags on the bridge, any VID received on an Ethernet port will be relayed to the corresponding DSL port and vice versa.

Note that the association between Ethernet and DSL ports is independent of the currently configured multipair mode of the DSL ports. If for example all four DSL wire pairs are combined to a single DSL span (DSL1) then Ethernet port ETH1 will be associated with DSL port DSL1 while ports ETH2 .. ETH4 and DSL2 .. DSL4 do not carry any traffic at all.

- 3) Transparent bridging with inband management. This mode is equivalent to the Transparent bridging mode but allows inband management through the DSL links, cf. 3.5.5.

The bridging modes are controlled by the monitor command `BRIDGEMODE`.

### 3.2.3 VLANs

The Watson 5 Ethernet plugin supports VLAN functions according to IEEE 802.1q. Each of the Ethernet bridge ports (ETH1 .. ETH4, DSL1 .. DSL4, MGMT3) can be member of one or several VLANs. The maximum number of VLANs is 64. Each VLAN has a VLAN Identifier (VID) between 1 and 4094.

Upon reception of an Ethernet packet at a port its VID is checked against the VIDs of all VLANs this port is a member of. Packets that do not carry one of these VIDs will be discarded.

For untagged packets the default VID for the port is used to determine VLAN membership.

Packets are only forwarded to ports that are a member of the VLAN of this packet.

Upon transmission the packet will be tagged with the VLAN tag originally received. If the packet was untagged then the default tag of the receiving port is added to the packet. The port can also be configured to send the packets untagged.

### 3.2.4 VLAN Examples

VLANs are always used within the Watson 5 Ethernet plugin to segregate traffic from different ports. This is true even when no VLAN tags are present on packets ingressing or egressing the plugin.

Figure 3-6 below shows a simple VLAN configuration example. Both on the DSL and on the Ethernet side untagged packets are used. On the Watson 5 Ethernet plugin four VLANs (VLAN 1, VLAN 2, VLAN 3 and VLAN 4) are configured. Depending on its ingress port each packet gets a default tag between 1 and 4. This tag is then used to switch the packet to the correct egress port, effectively connecting ETH1 to DSL1, ETH2 to DSL2 etc. while blocking all traffic between Ethernet ports and between DSL ports. The VLAN configuration of Figure 3-6 is automatically activated when issuing the `DEFAULT 2 monitor` command.

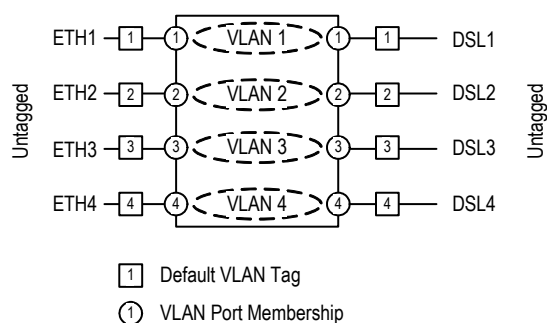


Figure 3-6: Simple VLAN Example

Figure 3-7 shows how the VLAN switching function can be used for traffic concentration:

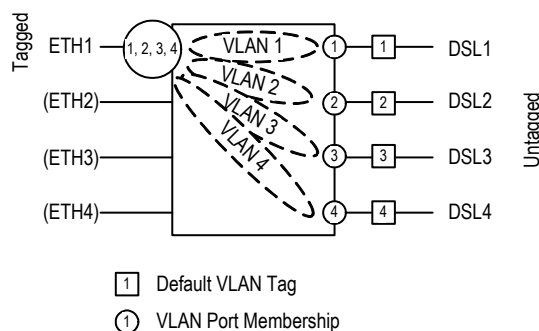


Figure 3-7: VLAN configuration for traffic concentration

In this example four independent DSL customers are concentrated to a single Ethernet trunk interface. On the DSL lines untagged packets are used. Upon ingress into the Watson 5 Ethernet plugin the packets get a default VLAN tag between 1 and 4 based on their ingress port. All traffic is switched to port ETH1 which is member of all four VLANs. The packets egress the Watson 5 Ethernet plugin with VLAN tags, allowing to separate traffic streams from the four DSL ports different customers. Ports ETH2 .. ETH4 are unused in this scenario.

Figure 3-8 shows how Ethernet user interfaces are used for inband management:

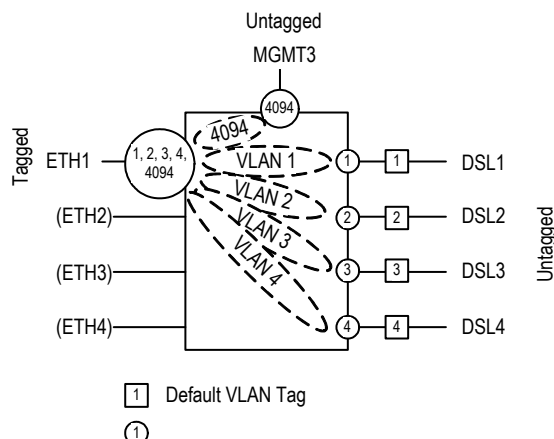


Figure 3-8: VLAN configuration for Inband Management

For user traffic we have the same configuration as in Figure 3-7. However we have added one additional VLAN 4094 which is used for inband management. Ports ETH1 and MGMT3 are members of this VLAN. Because the DSL ports are not member of VLAN 4094 management traffic is isolated from user traffic and there is no access to management function through the DSL ports.

Note that port MGMT3 must use untagged packets to properly interface with the card controller. Management packets coming from the card controller are tagged with VLAN 4094 upon ingress into the bridging function.

### 3.2.5 Individual and shared forwarding databases

VLANs can have individual or shared forwarding databases (IVL or SVL operation). The Watson 5 Ethernet plugin supports 16 separate forwarding databases which can be freely assigned to VLANs. Address learning is always done based on MAC addresses without taking VLANs into account.

IVL is required e.g. if a single server is connected to several Ethernet user ports on different VLANs and all of the server interfaces use the same MAC address. In this case the server MAC address will appear to move between Ethernet ports and VLANs depending upon which interface has most recently transmitted a frame. Communication to the server will be disrupted

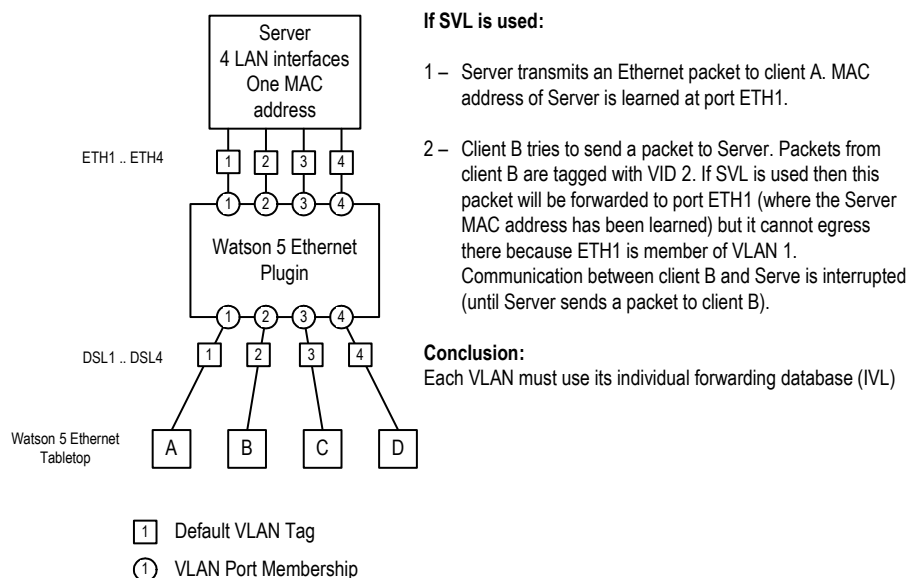


Figure 3-9: Individual VLAN learning (IVL) example

For IVL operation each VLAN is configured to use its own forwarding database.

SVL is used e.g. in asymmetric VLAN configurations. Asymmetric VLANs together with Port-based tagging allow several clients to access a common server while prohibiting the clients from talking to each other:

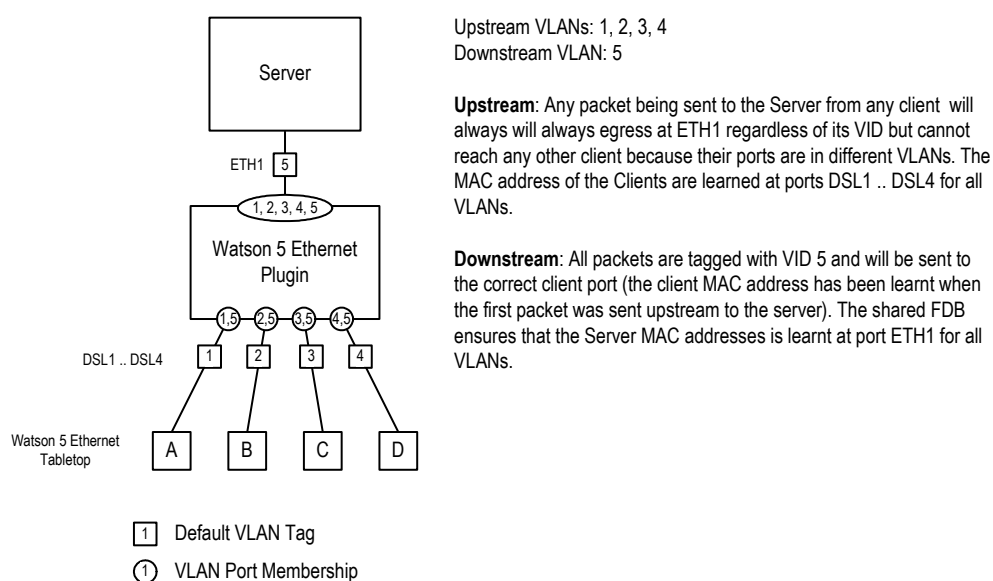


Figure 3-10: Shared VLAN learning (SVL) example

For SVL operation several VLANs are configured to use the same forwarding database.

**Notes:**

- The Watson 5 Ethernet tabletop modems do not support VLAN tagging. They are transparent for VLANs, i.e. VLAN tags are preserved during transmission over the DSL.
- The Watson 5 Ethernet tabletop modem has a single address learning database which does not take VIDs into account.

### 3.2.6 Stacked VLANs

The Watson 5 Ethernet plugin also supports double-tagged VLANs (a.k.a stacked VLANs). Stacked VLANs is a method to increase the number of available VLANs in a structured and hierarchical fashion that is backward-compatible with single-tagged VLANs as long as the network supports packet sizes of 1526 bytes or more.

This method places an extra tag (often referred to as the S-TAG or Service Provider Tag) in front of the first tag (known as the C-TAG or Customer Tag). The double tag format is shown in Figure 3-11.

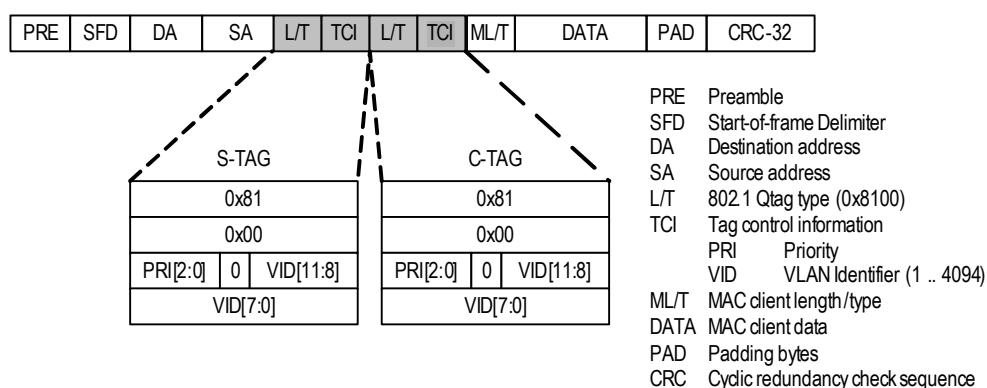


Figure 3-11: Stacked VLAN frame format

Each port can be configured for double tagging in incoming (ingress) and outgoing (egress) direction. Normally ingress and egress double tagging are enabled simultaneously.

A port with ingress double tagging enabled expects double tagged frames. The port will remove the outer tag. If a frame contains only a single tag then this tag will be removed. Untagged frames are not modified.

After removal of the outer tag the Ethernet bridge will process the packet as a single-tagged VLAN packet, cf. 3.2.3. For packets with a single tag or no tag the default tag for this port will be used to determine VLAN membership and possible egress ports.

A port with egress double tagging enabled will transmit all packets with an extra outer tag. When the packet had no tag, it will be sent with a single tag. When the packet had a single tag, it will egress double-tagged. The tag added is the default tag of the source port of the packet.

*Note: Stacked VLAN functions are not available on the Watson 5 Ethernet tabletop modems. The tabletop modems support frame sizes of 1526 bytes which means that they are transparent for double-tagged Ethernet packets.*

### 3.2.7 Class of Service (CoS)

The Watson 5 Ethernet plugin supports differentiated treatment of Ethernet packets according to their class of service. The plugin supports four different classes named Q1 .. Q4 (Q4 is the highest priority queue, Q1 has lowest priority), classification based on layer 2 or layer 3 information and ingress as well as egress rate limiting.

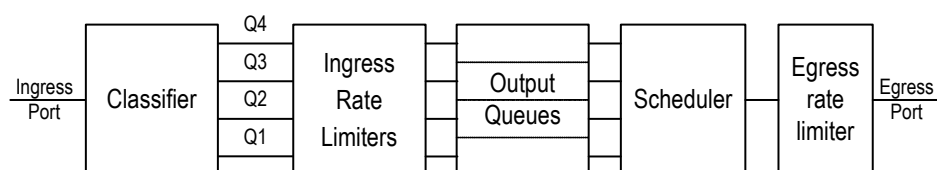


Figure 3-12: Class of Service functions

When a packet enters the Watson 5 Ethernet plugin its priority is be classified either by layer 2 information (IEEE 802.1p bits in the VLAN tag) or by layer 3 information (DSCP in the IP header). The packet is then associated with one of the priority levels.

On ingress each priority level can be individually rate limited according to the following rules:

- Q1 can be limited to 128 kbps, 256 kbps, 512 kbps, 1'024 kbps, 2'048 kbps, 4'096 kbps or 8'192 kbps
- Each higher priority level can be rate limited either to the same rate as the next lower priority level or to twice as much.

Table 3-4 gives an overview of all possible rate combinations (k → kbit/s, M → MBit/s):

Profile	Q1	Q2	Q3	Q4	Profile	Q1	Q2	Q3	Q4
1	128k	128k	128k	128k	2	128k	128k	128k	256k
3	256k	256k	256k	256k	4	256k	256k	256k	512k
5	512k	512k	512k	512k	6	512k	512k	512k	1M
7	1M	1M	1M	1M	8	1M	1M	1M	2M
9	2M	2M	2M	2M	10	2M	2M	2M	4M
11	4M	4M	4M	4M	12	4M	4M	4M	8M
13	8M	8M	8M	8M	14	8M	8M	8M	16M
15	128k	256k	256k	256k	16	128k	256k	256k	512k
17	256k	512k	512k	512k	18	256k	512k	512k	1M
19	512k	1M	1M	1M	20	512k	1M	1M	2M
21	1M	2M	2M	2M	22	1M	2M	2M	4M
23	2M	4M	4M	4M	24	2M	4M	4M	8M
25	4M	8M	8M	8M	26	4M	8M	8M	16M
27	8M	16M	16M	16M	28	8M	16M	16M	32M
29	128k	128k	256k	256k	30	128k	128k	256k	512k
31	256k	256k	512k	512k	32	256k	256k	512k	1M
33	512k	512k	1M	1M	34	512k	512k	1M	2M
35	1M	1M	2M	2M	36	1M	1M	2M	4M
37	2M	2M	4M	4M	38	2M	2M	4M	8M
39	4M	4M	8M	8M	40	4M	4M	8M	16M
41	8M	8M	16M	16M	42	8M	8M	16M	32M
43	128k	256k	512k	512k	44	128k	256k	512k	1M
45	256k	512k	1M	1M	46	256k	512k	1M	2M
47	512k	1M	2M	2M	48	512k	1M	2M	4M
49	1M	2M	4M	4M	50	1M	2M	4M	8M
51	2M	4M	8M	8M	52	2M	4M	8M	16M
53	4M	8M	16M	16M	54	4M	8M	16M	32M
55	8M	16M	32M	32M	56	8M	16M	32M	64M

Table 3-4: Ingress rate limiter profiles



Each combination of rates is associated with a profile number. This profile number is used in the `RATELIMIT IN` Monitor command to configure a particular combination of rates.

After classification and rate limiting the packets are sent to their output queues. A scheduler will schedule packets according to their priorities and send them to the egress port. The scheduler can be configured to work either in strict priority mode or in weighted fair queuing mode with fixed weights 8:4:2:1 for Q4:Q3:Q2:Q1 respectively.

Scheduling policy is a global setting and affects all ports simultaneously.

Finally the egress port can be rate limited according to the following profiles:

Profile	Rate
8	23.5M
7	11.8M
6	5.9M
5	2.9M
4	1.5M
3	734.4k
2	367.2k

Table 3-5: Egress rate limiter profiles

The profile number is used in the `RATELIMIT OUT` command to configure a particular egress rate. Only the entire port after scheduling can be rate limited, there are no individual queues at this stage.

*Note:* CoS functions are not available on the Watson 5 Ethernet tabletop modems.

## 3.3 Ethernet (tabletop modem)

### 3.3.1 Ethernet over DSL

The Watson 5 Ethernet tabletop modem uses the same HDLC procedure to transport Ethernet frames over DSL as the Watson 5 Ethernet plugin modem. Cf. 3.2.1

### 3.3.2 VLAN transparency

The Watson 5 Ethernet tabletop modem is transparent for VLAN tags according to IEEE 802.1p/q. This means that all Ethernet packets regardless whether they have a VLAN tag or not are handled correctly by Watson 5 Ethernet. However the filtering bridge of Watson 5 Ethernet is not VLAN aware. This means that packet forwarding and MAC address learning is performed without taking the VLAN tag into account.

### 3.3.3 Mixed mode operation

The Watson 5 Ethernet tabletop modems are interoperable with other TDM-based Watson 5 modems:

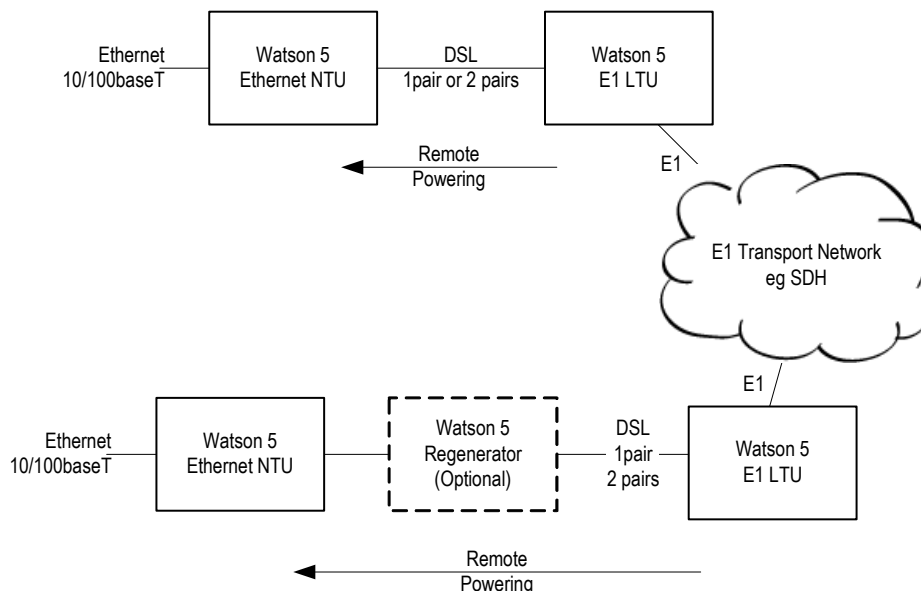


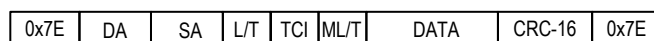
Figure 3-13: Mixed mode operation

One pair and two pair links are supported in mixed mode operation. The maximum throughput is 2.048 Mbps (32 timeslots) in E1 mixed mode operation and 4.6 Mbps (72 timeslots) in nx64 mixed mode operation. In mixed mode operation the Watson 5 Ethernet NTU can be powered from the LTU and the Watson 5 Regenerator is supported.

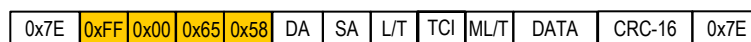
**Note:** *In mixed mode operation Firmware Version 2.0 or higher is required on the LTUs.*

### 3.3.4 Cisco HDLC

The Watson 5 Ethernet tabletop modem supports the "Cisco HDLC" formatting described in RFC 1547 with 16-bit FCS and bit-stuffed framing. In this mode an HDLC address and control field are inserted in the frame:



Transmitted on DSL with  
HDLC TAG OFF



Transmitted on DSL  
with HDLC TAG ON



Cisco HDLC

DA Destination address  
SA Source address  
L/T Length or type indicator = 802.1 QTagType  
TCI Tag control information  
ML/T MAC client length/type  
DATA MAC client data  
CRC Cyclic redundancy check sequence

Figure 3-14: Cisco HDLC

Cisco HDLC formatted packets can be decoded directly by the WAN-port of a router supporting Cisco HDLC, cf. Figure 2-4.

The Cisco HDLC formatting is controlled with the `HDLCCTAG Monitor` command. It is required if the Watson 5 Ethernet tabletop is used to directly interface with the WAN port of a router.

## 3.4 Firmware update

### 3.4.1 Plugin

Firmware of the Watson 5 Ethernet plugin can be updated remotely using the TFTP protocol. To load a new firmware package into a plugin, copy the package on the TFTP server and use the `UPDATE GET Monitor` command to load the new package into the plugin.

Once the new package is loaded in it must be activated. This is done with the `UPDATE COMMIT` command. The plugin will automatically reboot to activate the new firmware package.

If there are any problems with the newly loaded firmware package then it is possible to revert to the last installed package using the `UPDATE REVERT` command.

### 3.4.2 Tabletop

The Watson 5 Ethernet tabletop firmware can be upgraded either through the local RS-232 monitor port or remotely from a Watson 5 Ethernet plugin modem through the DSL link.

In the first case a PC with the Watson Flashloader application [7] must be used to load a new firmware package into the tabletop. This PC must be connected the RS-232 interface of the tabletop modem.

In the second case a new firmware package can be transferred into the tabletop through the DSL link and the Watson 5 Ethernet plugin using the TFTP protocol. This is controlled by the `DOWNLOAD` monitor command, cf. 7.4.4.

## 3.5 Management

### 3.5.1 Management interfaces

Watson 5 Ethernet modems have several management possibilities:

- Management through a local RS-232 port using a commandline interface (Monitor)
- DSL slave modems (STU-R) can be managed inband through the DSL EOC from the DSL master modem.
- The Watson 5 Ethernet plugin modem has a dedicated Ethernet interface (Q – Interface) for remote management through Telnet or SNMP.
- SNMP and Telnet management are also available through the Ethernet user interfaces of the Watson 5 Ethernet plugin modem (Ethernet inband management). Normally a dedicated management VLAN is used in this case.
- Ethernet inband management is also possible through a DSL link that is terminated by a Watson 5 Ethernet plugin modem.

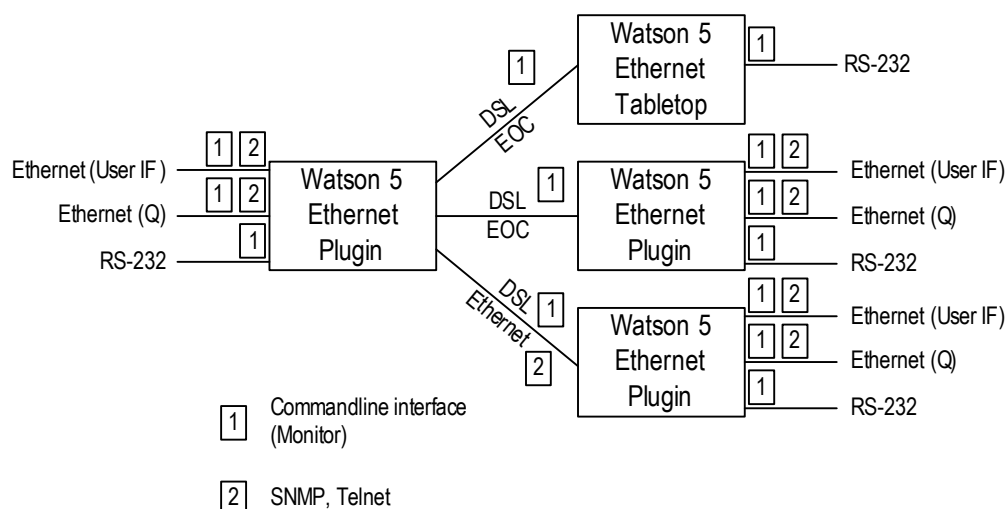


Figure 3-15: Management interfaces

Monitor access through the DSL EOC is only possible from a DSL master to a DSL slave. DSL Master/Slave configuration and the Autorestart option cannot be changed through the DSL EOC as doing so might result in loss of the communication between master and slave.

Telnet access gives the same commands as Monitor access through the local RS-232 port. However it is not possible to modify IP parameters through Telnet because doing so might result in loss of communication to the modem.

### 3.5.2 Chain Management through the DSL EOC

If several Watson 5 Ethernet plugins are connected in a linear network then the entire can be managed through the DSL EOC using the Monitor commands `CONNECT` and `DISCONNECT`. `CONNECT` connects to the modem on a particular DSL link. A next `CONNECT` will connect to the next modem in the chain. `DISCONNECT` disconnects one segment in the chain. To connect an entire chain at once you can use the combination `<ESC><ESC>` (the ESCAPPE key pressed twice).

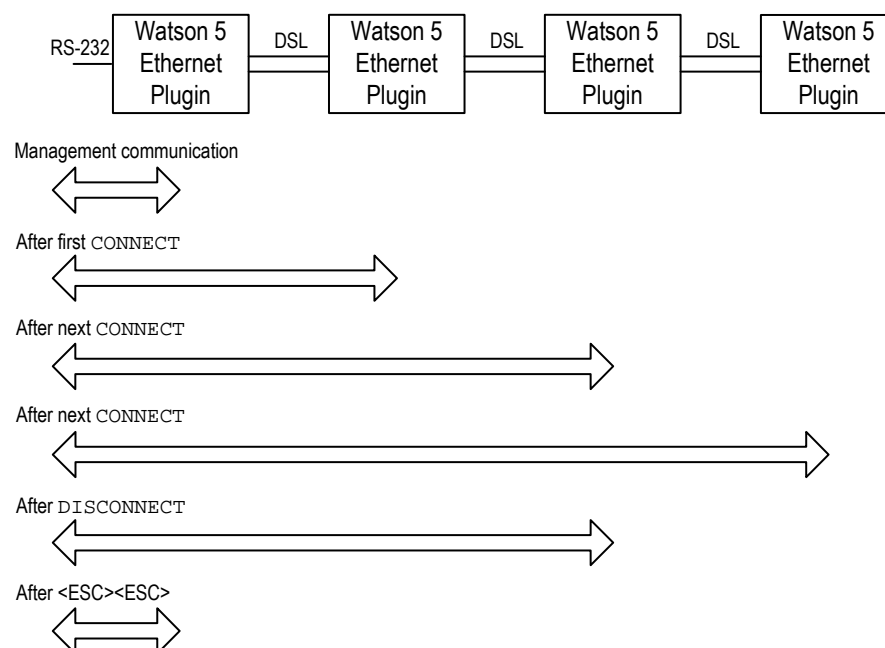


Figure 3-16: Chain Management through the DSL EOC

It is also possible (and recommended) to use Ethernet inband management over the DSL to manage a modem chain:

- SNMP is only possible with Ethernet inband management
  - the EOC has a limited bandwidth and CLI reaction times will be slow, especially on long chains
- However chain management through the EOC must be used sometimes, e.g. to set up IP configurations in the remote modems.

### 3.5.3 Management IP Address Configuration

Each Watson 5 Ethernet plugin contains a management router that connects three networks:

- one network at the Q – Interface (MGMT1) on the front panel of the modem
- one network at the backplane interface (MGMT2) on the subrack SZ.379.V3W
- one network at the internal interface (MGMT3) connecting to the Ethernet bridge

Cf. the block diagram of the Watson 5 Ethernet plugin Figure 3-4.

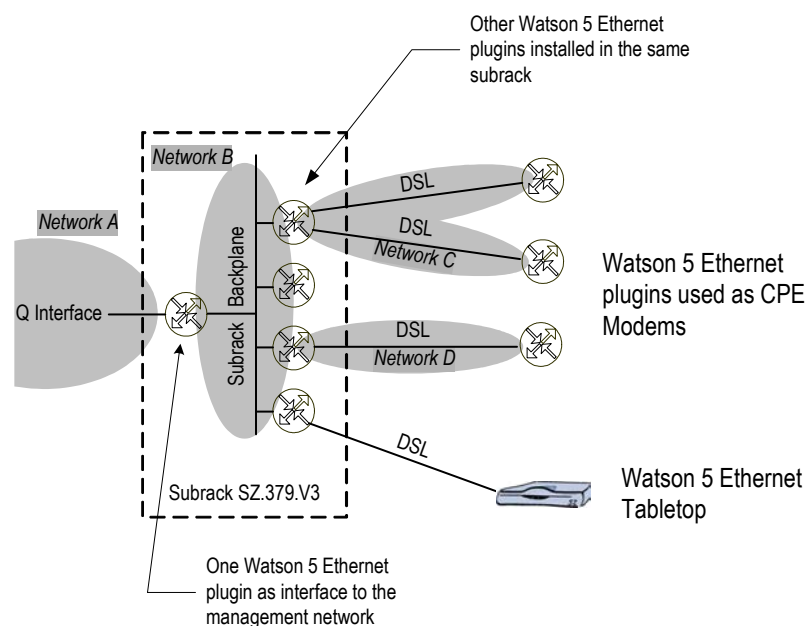


Figure 3-17: IP networks for Management

In a Watson 5 Ethernet system where several plugin cards are installed in a subrack and where the DSL links are also terminated with Watson 5 Ethernet plugin cards the following networks must be configured:

- one network (Network A) for the Q – Interface on the front panel of the modem which is connected to the management system
- one network (Network B) for the subrack connecting all backplane interfaces
- one network for all DSL links of a plugin. Within a subrack the DSL links of each plugin must be in separate networks (Networks C, D in Figure 3-17)

The Watson 5 Ethernet tabletop modem does not have management routing functions. No network has to be defined for DSL links that are terminate with the tabletop modem.

### 3.5.4 Management VLAN configuration

The Watson 5 Ethernet plugin modems support Ethernet inband management, i.e. it is possible to manage the modems through the Ethernet user interfaces or through the Ethernet payload carried over the DSL.

Ethernet inband management traffic is always routed through the internal management port MGMT3 that connects the plugin controller to the Ethernet bridge.

To configure Ethernet inband management and to isolate management traffic from user traffic a dedicated management VLAN has to be set up. By default the MGMT3 port is member of VLAN 4094, but it is possible to use a VID different from 4094 for management traffic.

To access MGMT3 from a user interface this user interface (ETH1 .. ETH4) has to be member of the management VLAN. To access MGMT3 through the DSL Ethernet payload the corresponding DSL port (DSL1 .. DSL4) has to be member of the management VLAN.

### 3.5.5 Management VLAN with transparent bridging

The Watson 5 Ethernet plugin supports a special bridging mode that allows for inband management in combination with transparent bridging. This bridging mode uses stacked VLAN tags for packets from the Ethernet user interfaces and single-tagged packets for management information on the DSL interfaces:

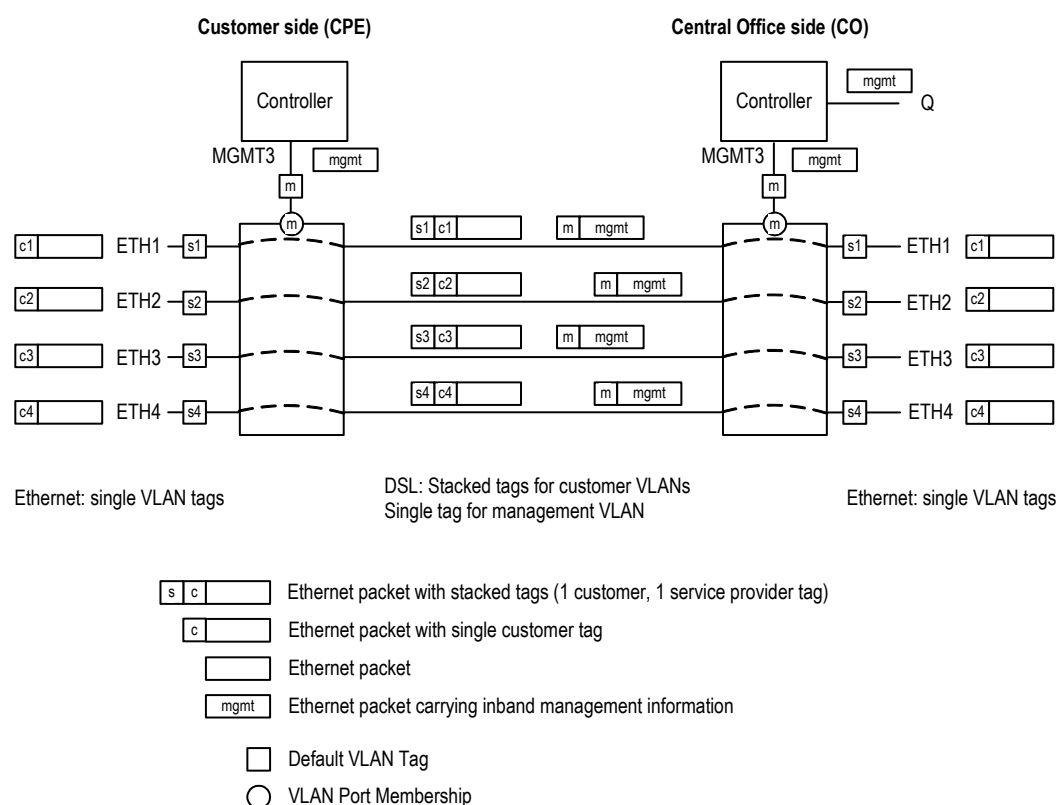


Figure 3-18: Management VLAN configuration with transparent bridging

Management packets ingressing at the Q – interface of the Central Office are routed to port MGMT3 of the management controller. There they are tagged with the default VLAN tag m and are sent as single-tagged packets over the DSL to the Watson 5 Ethernet plugin at the Customer side.

At the Customer side the outer tag is stripped off, leaving management packets untagged. VLAN switching will send these packets to port MGMT3 which is member of VLAN m.

Single-tagged packets ingressing at ports ETH1 .. ETH4 of the CPE modem will be tagged with an outer tag s1 .. s4 depending on their ingress port and then sent over the DSL. At the CO side the outer tag is stripped off, leaving single-tagged packets egressing the CO modem at ETH1 .. ETH4.

## 3.6 G.826 Performance Monitoring

Watson 5 Ethernet modems support performance monitoring as specified in ITU-T G.826. The G.826 error performance parameters provide quantitative performance information of a specific loop. They are intended to be used for long-term evaluation of operating DSL links.

The evaluation of the G.826 error performance parameters is based on CRC (Cyclic Redundancy Check) error detection. The estimation of a bit-error rate is not within the scope of the G.826 calculations.

On the DSL side, six CRC6 check bits are generated per DSL frame for each channel and direction. The software counts block errors and evaluates the error performance according to ITU-T G.826 using these CRC6 bits.

G.826 statistics are available with the `G826 Monitor` command.

## 3.7 Test loops

Test loops can be activated via the Monitor or SNMP. Loop 1 will initiate a loopback on a local Ethernet interface, Loop 2 will initiate a loopback on a remote DSL interface. Only one test loop can be active at a given time.

Activation of a test loop will deactivate any previous loop. A system reset will deactivate any test loop. A non-urgent alarm is raised while any loop is active.

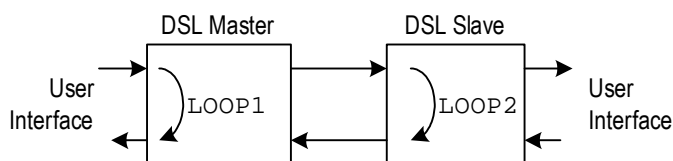


Figure 3-19: Test Loops controlled by the DSL Master

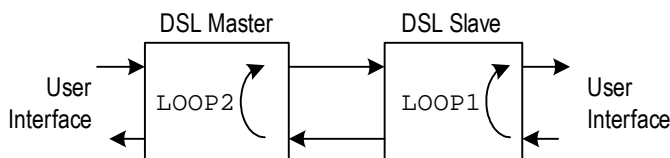


Figure 3-20: Test Loops controlled by the DSL Slave

### Notes:

- The looped-back Ethernet packets egress the modems from the same port they were sent to and have the same source and destination addresses they were sent with. While Ethernet testing equipment can handle this situation it might be very confusing for "normal" Ethernet ports or Ethernet switches.
- The Watson 5 Ethernet tabletop modems operated as DSL slave can only control LOOP1.

## 3.8 Password protection

The Watson 5 Ethernet modems feature password protection to management functions to prevent unauthorized access e.g. on a modem that is installed at a customer site but is owned and managed by the service provider.

Password protection is global i.e. once the correct password is entered access to all commands is granted.

By default password protection is disabled. To enable it use the `SET PASSWORD` command to define a password and then use the `LOGOFF` command to lock access to the Monitor. Now Moni-



tor access must be enabled by entering the password before any Monitor commands can be entered.

Once the password is entered all Monitor commands are available. The password has to be re-entered

- after each LOGOFF
- after 5 minutes of inactivity
- after a restart of the modem

Passwords can be changed with the `CHANGE PASSWORD` command. To disable password protection use the `CLEAR PASSWORD` command.

Password protection is only applied to access from the local RS-232 interface. Monitor access through the DSL EOC is never protected by the password. If a password has been lost then it can be reset through the DSL EOC with the `CLEAR PASSWORD` and `SET PASSWORD` commands.

Of course this is only possible if the modem who's password has been lost is configured as DSL slave. If it is configured as DSL master then no remote access through the DSL EOC is possible. In this situation the modem can be configured as DSL slave with the `DSL_SLAVE` command which can be entered at the prompt for the password. After `DSL_SLAVE` the modem will be reconfigured as DSL slave and the password can be reset from the DSL master as described above.



## 4.1 Plugin

Each plugin is fed via the subrack backplane with (dual) -48VDC (referenced to 0VDC of the exchange battery). The minirack mechanics has two -48VDC inputs and on model SZ.876.V100 also an AC powering input. The plugin generates the used voltages onboard.

The ground reference of all voltages on the secondary side of the plugins DC/DC-converter is tied to FPE (Functional Protective Earth).

Additionally, the plugin is fed over the backplane with an auxiliary +5VDC supply (referenced to ground) generated on the ACU. The only purpose of this voltage is to drive the alarm circuitry on each plugin, even in the case of a failure of the plugin onboard DC/DC-converter.

## 4.2 Tabletop

The tabletop modem is normally powered locally from an AC/DC adapter with 48VDC output. Power adapter SZ.410.080.V1E is available from Schmid Telecom to power the tabletop modem.

*Caution: Do not connect a 48VDC supply directly to the "AC/DC adapter" connector! High voltage transients from the DSL line may damage other equipment connected to the battery. A DC/DC converter with 4kV transient isolation voltage must be used in this case.*

*Caution: The local supply voltage input is protected against reversal of polarity but not fused. Appropriate fusing has to be done externally.*

If connected to a Watson 5 plugin modem with remote powering functions then the tabletop can also be powered through the DSL. Switching between local and remote powering is done automatically with local powering taking precedence over remote powering.

*Note: Remote powering functions are only available on plugin modems with E1 or nx64 user interfaces. The Watson 5 Ethernet plugin does not support remote powering of a tabletop.*

The ground of the tabletop modem is normally floating when referenced to earth. A ground connector (Faston type) is available on the rear panel of the modem.



## 5.1 Plugin LEDs

The plugin is equipped with four LEDs. Depending on the currently selected CARDMODE the LEDs are mapped to local and remote status as follows:

Cardmode								
1 (4 x 1p)			2 (2 x 2p)		3 (1 x 2 + 2x1p)		4 (1 x 4p)	
LED	Span	Function	Span	Function	Span	Function	Span	Function
A	DSL1	Local Status	DSL1	Local Status	DSL1	Local Status	DSL1	Local Status
B	DSL 2	Local Status	DSL1	Remote Status	DSL1	Remote Status	DSL1	Remote Status
C	DSL 3	Local Status	DSL3	Local Status	DSL3	Local Status	-	Off
D	DSL 4	Local Status	DSL3	Remote Status	DSL4	Local Status	-	Off

Table 5-1: LED mapping for plugin

The "Local Status" LED indicates the status of the local end of the DSL span (STU-C side). The Remote Status" LED indicates the status of the remote end of the DSL span (STU-R side). If the modem is configured as DSL slave then only the local status is indicated, the "Remote Status" LED is switched off.

### 5.1.1 Plugin LED Indications

Status	LED
Power failure	Off
Hardware / Software failure	blinking red
Normal operation (Master)	Green
Normal operation (Slave)	Green
Non-urgent alarms (local/remote) or loop active	Amber
Urgent alarms (local/remote)	Red

Table 5-2: Plugin LED indications

## 5.2 Tabletop LEDs

### 5.2.1 Front LEDs

The tabletops are fitted with two LEDs labeled "1" and "2" ("Local" and "Remote" on some older modems, "1" is equivalent to "Local" and "2" to "Remote"). The LEDs display the local status and (if the tabletop is configured as a DSL master) the remote status:

Status	LED "1"	LED "2"
Power failure	Off	Off
Hardware / Software failure	Blinking red	Off
Memory Selftest Failure (Watson 5 Ethernet tabletop only)	Off	Red
Normal operation (Master)	Green	Green
Normal operation (Slave)	Green	Off
User Interface Activity on Tx (Slave)	Green	Blinking Green
User Interface Activity on Rx (Slave)	Green	Blinking Amber
Non-urgent alarms (local/remote) or loop active	Amber	Amber (off for Slave)
Urgent alarms (local/remote)	Red	Red (off for Slave)

Table 5-3: Tabletop front LED indications

During Firmware download the LEDs are used as follows:

Download Status	LED "Local"	LED "Remote"
Flash erase	blinking red	Off
Download in progress	blinking green	Off
Download completed	blinking amber	Off
Activating remotely downloaded firmware	Off	blinking amber

Table 5-4: Tabletop front LED indications during firmware download

### 5.2.2 Back LEDs

The Watson 5 Ethernet tabletop modem is fitted with 3 LEDs on the backpanel indicating the status of the Ethernet interface:

LED	Indication
ACT	Green if link activity on the Ethernet port
COL	Yellow if collision on Ethernet port is detected
HS	Green if interface is operating at 100 MBit/s. Off if interface is operating at 10 MBit/s

Table 5-5: Tabletop backpanel LED indications

## 5.3 Alarm Conditions

An alarm condition is displayed on the LEDs if one of the following conditions occurs:

***Urgent alarm (red):***

- Hardware or software failure (blinking)
- Loss of signal / frame alignment on the DSL side (LOSW)
- DSL block-error-rate according G.826  $\geq 30\%$  (BER-H)
- plugin only: overcurrent detected in remote power feeding circuit (CLD)

***Non-urgent alarm (amber):***

- DSL block-error-rate according G.826  $> 15\%$  (BER-L)
- Either Loop 1, Loop 2, Analog Loopback, or the Regenerator Loopback is active (LOOP1, LOOP2, BERT)
- Link integrity alarm on Ethernet user interface
- Alarm cut off is activated (ACO)

## 5.4 Alarm Relays

### 5.4.1 Plugin

Plugin alarms can be signaled through relay contacts present on the ACU2R which is normally installed in the subrack. Two relays are present on the ACU2R for urgent and non-urgent alarms.

*Note:* The ACU-48R is not compatible with the Watson 5 Ethernet plugin.

Under normal plugin power conditions the two output stages of each plugin are controlled by its microcontroller. In case of a power failure on an plugin, both the “Urgent” and “Non-urgent” alarms will be activated on the ACU. (The ACU generates an auxiliary +5 V<sub>DC</sub> which is used to pull-up the open collector alarm output stages of the plugins.)

Both minirack mechanics and the plugin tabletop housing have urgent and non-urgent alarm relay contacts.

***Urgent Alarm:***

- At least one of the plugin – LEDs displays an urgent alarm
- Power failure of any one of the plugins
- Power failure of the auxiliary +5V<sub>DC</sub> auxiliary supply on the ACU
- Power failure of both –48V<sub>DC</sub> supplies

***Non-urgent Alarm:***

- At least one of the plugin – LEDs displays a non-urgent alarm and none of the plugin – LEDs displays an urgent alarm
- Power failure of any one of the plugins
- Power failure of the auxiliary +5V<sub>DC</sub> auxiliary supply on the ACU
- Power failure of one of the –48 V<sub>DC</sub> supplies

*Note:* If alarm cut off is activated (ACO = on), the alarm relays are disabled.

## 5.4.2 Tabletop

Two alarm relay contacts “Urgent” and “Non-urgent” are located on the Monitor connector of the tabletop.

### Alarm Conditions

#### **Urgent Alarm:**

- At least one of the tabletop - LEDs is red

#### **Non-urgent Alarm:**

- At least one of the tabletop - LEDs is amber and none of the tabletop - LEDs is red

#### *Note:*

- *In case of remote powering the alarm relays are kept inactive to save power*
- *If alarm cut off is activated (ACO = on), the alarm relays are disabled.*

## 5.5 Initialization Errors

At system startup, various hardware selftests are performed. If any initialization errors occur, the startup procedure will be aborted and the Monitor of the Watson 5 Ethernet plugin displays an error message.

On the Watson 5 Ethernet tabletop an initialization error code in hexadecimal representation is displayed:

Error Code	Error Variable	Initialization Error
0x0001	RAM_ERROR	Microcontroller RAM test failure
0x0002	EEPROM_ERROR	EEPROM test failure
0x0004	XDSL_ERROR	Framer initialization failure
0x0008	TCVR_A_ERROR	DSL transceiver failure (Loop A)
0x0010	TCVR_B_ERROR	DSL transceiver failure (Loop B)
0x1000	TCVR_C_ERROR	DSL transceiver failure (Loop C)
0x2000	TCVR_D_ERROR	DSL transceiver failure (Loop D)
0x0080	ETHERNET_ERROR	Ethernet interface initialization failure
0x8000	SW_PROTECT_ERROR	Software Copyright Protection Error

Table 5-6: Software Initialization Errors (tabletop modem).

If several errors are detected simultaneously then the error code displayed is a combination (OR) of the individual error codes, e.g. 0x83 will be displayed if during selftest the RAM test fails, the EEPROM test fails and the Ethernet interface cannot be initialized.



## 6.1 Introduction

For configuration and diagnostics the modems have a serial interface to connect a terminal or a PC with terminal emulation. The serial interface is available on the backplane of the tabletops, on the ACU, the minirack mechanics and the plugin tabletop housing.

A modem configured as DSL slave is also accessible from the master side through the DSL EOC.

The Monitor terminal or terminal emulation must be VT100 compatible and must be configured as follows:

- 9600 baud, asynchronous
- 8 bits, no parity, one stop bit
- No new line on carriage return (i.e. no line feed on carriage return)
- XON/XOFF enabled

*Notes:*

- *Between plugin and the terminal the XON/XOFF protocol is used for flow control. In order to re-enable communication with an plugin occasionally left in XOFF state, it is recommended to start each session with Ctrl-Q (=XON) followed by an ECHO command.*
- *If you use the HyperTerm terminal emulator delivered with Windows® then you must configure HyperTerm for VT100 emulation in the "Settings" tab of the connection properties (File – Properties).*

## 6.2 Addressing of Plugins

### 6.2.1 Plugin in Subrack

The Monitor terminal connects through the ACU to a serial bus on the subrack backplane which is accessible by all plugins.

At any time, only one of the plugins in the subrack can be logically connected to the Monitor interface. The appropriate plugin interface is addressed (i.e. selected) according to its physical position in the subrack, starting with the leftmost slot number 01 and ascending rightwards to number 12. To select a plugin in slot number *nn* just type *%nn* in the terminal, e.g. to select the plugin in slot 7 type *%07*.

Unit	LTU	LTU	LTU	LTU	LTU	LTU	LTU	LTU	LTU	LTU	LTU	LTU	ACU	PSB
Address	%01	%02	%03	%04	%05	%06	%07	%08	%09	%10	%11	%12		

Figure 6-1: Plugin Addressing Scheme

To see which units in a rack are available, you can use the `ECHO` command. Each unit will respond with its associated slot number (%SN).

The response could be: *%01 %03 %08 %10 %11*

**Notes:**

- *The `ECHO` command is not echoed on the terminal*
- *The selection command (*%nn*) is not echoed on the terminal*
- *Each command must be terminated by a carriage return.*

### 6.2.2 Plugin in Minirack mechanics or tabletop housing

No addressing procedure is required in these cases. After power-up the Monitor menu appears directly.

### 6.2.3 Tabletop

There is no addressing procedure required for Tabletop modems. After power-up of a Tabletop modem the Monitor menu appears.

## 6.3 Naming of ports

Many commands of the Monitor relate to a particular port. These ports are identified as follows:

Port	Name
Bridge port of 1 <sup>st</sup> DSL span	DSL1
Bridge port of 2 <sup>nd</sup> DSL span	DSL2
Bridge port of 3 <sup>rd</sup> DSL span	DSL3
Bridge port of 4 <sup>th</sup> DSL span	DSL4
1 <sup>st</sup> Ethernet user interface	ETH1
2 <sup>nd</sup> Ethernet user interface	ETH2
3 <sup>rd</sup> Ethernet user interface	ETH3
4 <sup>th</sup> Ethernet user interface	ETH4
1 <sup>st</sup> Management Ethernet interface (Q)	MGMT1
2 <sup>nd</sup> Management Interface (Backplane)	MGMT2
3 <sup>rd</sup> Management Interface (Bridge)	MGMT3

Table 6-1: Port naming

Cf. also Figure 3-4.

The number of DSL spans varies depending on the card configuration set by the `CARDMODE` command, cf. Table 3-1.

## 6.4 Telnet Access

To use a remote Monitor through Telnet on the Watson 5 Ethernet plugin you first have to configure the IP address of the plugin through a monitor on the RS-232 interface with the `MGMTIP` command.

Then use any Telnet client to open a telnet session into the modem. You will see a Telnet welcome screen:

```
+-----+
|      Welcome to Watson 5 Ethernet Quad LTU      |
| (C) by Schmid Telecom AG Zuerich, Switzerland |
+-----+

OS/HW:  Linux ppc 2.4.20
Nodename:  SzW5EthLtu

SzW5EthLtu login:
```

Enter username and password to display the Monitor Welcome Screen.

*Note:* The default username is `root`, the default password is `sz`. It is not possible to change these.

## 6.5 Monitor Command Structure

### 6.5.1 Welcome Screen

After connecting the Terminal/PC the welcome screen is shown with information about the modem type and Firmware Version, e.g.:

```

Watson 5 SHDSL Ethernet
ZRH01
Monitor V2.0
Copyright (C) 2001-2006 by Schmid Telecom AG Zuerich, Switzerland

+-----+
| Main Menu |
+-----+

1. Performance management (PM)
2. Fault and maintenance management (FMM)
3. Configuration management (CM)
4. Security and remote management (SM)
5. Exit

```

LTU\_01>

To select the desired sub-menu, type the appropriate number.

The available Monitor commands are described in chapter 7.

Notes:

- The *Exit* command is only available on the plugin if it is installed in a subrack or accessed via Telnet..
- To address another plugin in the subrack after *Exit* type %nn (nn = slot number)

### 6.5.2 Menus

The Monitor menu is structured in the following sub-sets:

Subset	Short-form
Performance management	PM
Fault and maintenance management	FMM
Configuration management	CM
Security and remote management	SM

Table 6-2: Monitor Command Subsets

### 6.5.3 Prefixes an Shortcuts

The available commands depend on the submenu currently active.

To access a command from a different submenu the command can be prefixed with the name of the submenu and a . (Dot), e.g. you can use PM.SHDSL 1 to display the G.826 statistics for SHDSL link 1 while in the Configuration submenu. If the Performance Management submenu is active then SHDSL 1 will display the G.826 statistics and CM.SHDSL 1 will display the configuration of DSL link 1.

Note:

*Prefixing is only available on the Watson 5 Ethernet plugin.*

The most popular commands are available in all submenus as shortcuts:

Command	Shortcut
CONNECT	CON
DIAGNOSTIC	DIA
DISCONNECT	DIS or <ESC> key

Table 6-3: Command Shortcuts

## 6.5.4 Tab completion

You can use tab completion to simplify typing of long commands. By typing the <TAB> character in after entering the first character(s) of a command word the Monitor will try to complete the command as much as possible. Example:

LTU\_01\_CM> .SN <TAB> will do a partial completion of the command to

LTU\_01\_CM> SNMP

Typing now C <TAB> will complete the command to

LTU\_01\_CM> SNMPCOMMUNITY

Notes:

- Tab completion is only possible for commands, not for parameters.
- Tab completion is only available on the Watson 5 Ethernet plugin.

## 6.5.5 Help

Typing H or HELP at any submenu will list all commands available in that submenu in alphabetical order. Typing H *Command* (or HELP *Command*) will display help for a particular command.

## 6.5.6 Command History

The Watson 5 Ethernet plugin keeps a command history. To recall a command recently entered use the up-arrow and down-arrow keys to scroll through the history of commands. Commands may be edited by using the DEL key and the cursor keys.

## 6.5.7 Continuous Displays

Some commands (DIAGNOSTIC, G.826, BERT) continuously update the screen with the latest information. These commands will stop updating the screen if a new command is entered that generates displays with more than one line. (e.g. CONFIG, STATUS, ALARM, READER).



## 7.1 Configuration Management CM

### 7.1.1 General Commands

**ADMIN-NAME** [ *SYSTEM String* | *DSLx String* ]

Defines an administrative name for the plugin or for one of the DSL links.

The administrative names of the system is displayed in the Monitor welcome screen, the administrative names of the DSL links in the *STATUS* display. Use quotes ( " ") to enter upper/lowercase administrative names.

The command *ADMIN-NAME* without parameters will display all currently configured administrative names.

*Note*      *This command is not available on the Watson 5 Ethernet tabletop modem.*

**ADMINSTATUS** *Port* **UP** | **DOWN**

Set the administrative state of a port.

**Parameters:**

<i>Port</i>	Port (DSL1 .. DSL4, ETH1 .. ETH4)
UP, DOWN	Administratively enable (UP) or disable (DOWN) the port.

Ports that are set to *DOWN* are blocked for traffic and do not create any alarms. The currently active administrative status is displayed in the *STATUS* and *STATUS ETHERNET* commands.

*Note*      *This command is not available on the Watson 5 Ethernet tabletop modem.*

## **CARDMODE [ mode ]**

The Watson 5 Ethernet plugin can be configured flexibly to support 1/2/4 pair operation. This is done with the **CARDMODE** command. Entering **CARDMODE** without any parameter will display the current plugin mode:

```
LTU_01_CM> CARDMODE
Current cardmode: 4x1 pair (mode 1)
Bridge Port          Wire Pair
~~~~~
DSL1 <----->    a1a2
DSL2 <----->    b1b2
DSL3 <----->    c1c2
DSL4 <----->    d1d2
~~~~~
```

Available modes:

1	4x1p, four independent 1-pair systems
2	2x2p, two independent 1-pair systems
3	1x2p + 2x1p, one 2-pair and two 1-pair systems
4	1x4p, one 4-pair system

Table 7-1 : CARDMODES

When changing the cardmode, the newly configured DSL links will be reset and their configuration set to the default configuration of the new mode as defined in Table 7-2. Note that only the DSL defaults are set, the Ethernet interface configuration is not changed by **CARDMODE**. For security reasons, the command must be confirmed.

*Note* This command is not available on the Watson 5 Ethernet tabletop modem.

## **DEFAULT (Plugin)**

The **DEFAULT** command sets a default configuration. The following default settings are available on the plugin:

Parameter	DEFAULT 0	DEFAULT 1	DEFAULT 2
<b>SHDSL</b>			
Master/Slave	Master	Master	Master
Autorestart	Enabled	Enabled	Enabled
Power Backoff	Enabled	Enabled	Enabled
Linerate per span	8'192 kbit/s	4'096 kbit/s	2'048 kbit/s
Operating Mode	1 x 4 Pair	2 x 2 Pair	4 x 1 Pair
DSL Sync rate per pair	2'056 kbit/s	2'056 kbit/s	2'056 kbit/s
<b>Ethernet</b>			
Interface mode	Auto	Auto	Auto
Flow control	Auto	Auto	Auto
<b>VLAN Settings</b>			
Bridgemode	1 (VLAN Bridging)	1 (VLAN Bridging)	1 (VLAN Bridging)
VLANs	VLAN 1 ETH1, DSL1	VLAN 1 ETH1 DSL1 VLAN 2 ETH3 DSL3	VLAN 1 ETH1 DSL1 VLAN 2 ETH2 DSL2 VLAN 3 ETH3 DSL3 VLAN 4 ETH4 DSL4

Table 7-2: DEFAULT values



- Notes:
- In default configuration 0 the Ethernet interfaces 2, 3 and 4 are not configured to any VLAN and cannot carry traffic
  - In default configuration 1 the Ethernet interfaces 2 and 4 are not configured to any VLAN and cannot carry traffic

#### DEFAULT (Tabletop)

For the Watson 5 Ethernet tabletop modems the DEFAULT values are as follows:

Parameter	DEFAULT 0	DEFAULT 1	DEFAULT 2
<b>SHDSL</b>			
Autorestart	Enabled	Enabled	Enabled
Power Backoff	Disabled	Disabled	Disabled
Linerate	2048 kbit/s	2304 kbit/s	4608 kbit/s
Operating Mode	1 Pair	1 Pair	2 Pairs
DSL Sync rate	2056 kbit/s	2312 kbit/s	2312 kbit/s
<b>Ethernet</b>			
Interface mode	Auto	Auto	Auto
Flow control	Auto	Auto	Auto
Bridge filtering	Enable	Enable	Enable
Clock mode	Remote	Remote	Remote
Bitrate	2048 kbit/s	2304 kbit/s	4608 kbit/s
HDLC tagging	Off	Off	Off

Table 7-3: DEFAULT values for Watson 5 Ethernet tabletop

- Notes
- The default configurations in Table 7-3 are given for DSL master mode. If the modem is in DSL slave mode then the DSL linerate is determined by the DSL master and not by the DEFAULT command.
  - The factory setting can be loaded using the DEFAULT 2 command. All DSL plugins and table-tops are delivered with this configuration (plugins as DSL master, table-tops as DSL slave).
  - The Master/Slave and Remote Powering settings are not affected by the DEFAULT command

## 7.1.2 DSL Configuration (Plugin)

### **BACKOFF *DSL-Port* ON | OFF**

Set SHDSL Power Back-Off function ON / OFF for a particular DSL port. The default setting is BACKOFF ON.

### **CONFIG DSL *DSL-Port***

The CONFIG command displays the current configuration of a DSL ports of the unit. You can also use CONFIG *DSL-Port* as a shortcut.

```
LTU_01_CM> CONFIG DSL1
~~~~~
Local Configuration of SHDSL Span No 1
~~~~~
Master/Slave      : Master
Autorestart       : Enabled
Power Backoff     : Enabled
Payload Rate (max): 2048 kbit/s
Wire Pairs        : 1
Line Rate         : 2056 kbit/s
Line Code         : PAM-16
~~~~~
```

### **LINERATE *DSL-Port n p***

Set line rate for a DSL port

#### **Parameters:**

*DSL-Port*

*n* denotes the number of DSL timeslots to be transmitted ( $3 \leq n \leq 89$ )

*p* denotes the linecode: *p* = 16 for TC-PAM 16, *p* = 32 for TC-PAM 32. If possible (i.e. consistent with *n*) the DSL link will be configured with this desired linecode. If this parameter is omitted, PAM-16 will be configured when possible and PAM-32 otherwise.

### **MASTER *DSL-Port* ON / OFF**

Set DSL master mode ON/OFF for a DSL port. On the Watson 5 Ethernet plugin each DSL link can be configured individually as master or slave.

### **RESTART *DSL-Port* ON / OFF**

Set Autorestart ON / OFF for a DSL port

### 7.1.3 DSL Configuration (Tabletop)

There is only one DSL interface available on the tabletop modem. The DSL configuration commands are somewhat simplified.

#### **BACKOFF ON / OFF**

Set SHDSL Power Back-Off function ON / OFF.

#### **CONFIG**

Shows the current configuration (DSL and Ethernet ports)

```
NTU_CM_REMOTE> CONFIG
~~~~~
Local Configuration                                     Id : Ethernet
~~~~~
Ethernet
  Bit Rate       : 32 x 64 = 02048 kbit/s
  Interface mode : Auto Negotiation
  Flow Control   : Auto
  Bridge filter  : Enabled
  Clock Mode     : Remote
  Insert HDLC Tag : Disabled
SHDSL
  Master/Slave   : Slave
  Autorestart    : Enabled
  Power Backoff  : Disabled
  Payload Rate   : 02048 kbit/s
  Operating Mode : 1 Pair
  Line Rate      : 02056 kbit/s
~~~~~
```

#### **LINERATE n i a**

Set line rate:

##### **Parameters:**

- n denotes the number of DSL timeslots to be transmitted ( $3 \leq n \leq 36$ )
- i 1 denotes the Z-bits automatically used to increase the EOC bandwidth of about 3.2 kbit/s by 8 kbit/s (i = 0 or 1, default i = 1)
- a 1 denotes asymmetric PSD operation.

##### **Notes**

- The LINERATE command is only available if the modem is acting as a DSL master (MASTER ON). If the modem is configured as DSL slave then the linerate is set by the master.
- Use of Z-bits for the EOC and asymmetric PSD operation is provided for compatibility of the Watson 5 Ethernet tabletop with TDM-based Watson 5 modems, cf. [1]. The Watson 5 Ethernet plugin does not support these features.

#### **MASTER ON / OFF**

Set DSL master mode ON/OFF.

#### **MODE 1 | 2**

Select DSL operating mode:

- 1: 1 pair operation
- 2: 2 pair operation

## RESTART ON / OFF

Set Autorestart ON / OFF.

## 7.1.4 Ethernet Configuration (Plugin)

### **FDX Ethernet-Port mode**

Sets duplex mode and speed of an Ethernet port (ETH1 .. ETH4).

Possible values for *mode* :

AUTO	Autonegotiation of parameters
10H	10 MBit/s, half duplex
10F	10 MBit/s, full duplex
100H	100 MBit/s, half duplex
100F	100 MBit/s, full duplex

### **FLOW Ethernet-Port AUTO / ON / OFF**

Ethernet flow control:

AUTO	Auto negotiation
ON	flow control enabled
OFF	flow control disabled

Flow control is implemented with PAUSE frames in full duplex mode and with backpressure (forced collisions) in half duplex mode.

**Note** *It is not possible to auto-negotiate flow control without auto-negotiating speed and duplex modes. Setting FDX to a value different from AUTO and then setting FLOW to AUTO results in disabling flow control, i. e. has the same effect as FLOW OFF.*

## 7.1.5 Ethernet Configuration (Tabletop)

### **BITRATE n**

Defines the bandwidth of bridged data between Ethernet and DSL interface (*n* = number of 64 kbit/s timeslots, 1 .. 72).

Must be aligned to the linerate on the DSL link.

When the bitrate configured with the BITRATE command exceeds the available DSL linerate an appropriate warning is displayed.

Cf. chapter 3.2

### **CONFIG**

Displays the current configuration of DSL and Ethernet ports. Cf. 7.1.3.

### **CLOCKMODE 0 | 1**

Determines the clock source used to transfer data from MAC layer of the Ethernet interface to the DSL interface.

0	internal clock. Recommended configuration for modems operating as DSL masters
1	remote clock. Recommended configuration for modems operating as DSL slaves.

### **FDX mode**

Ethernet interface operating mode. Possible values for *mode* :

AUTO Auto negotiation (factory default)  
10H 10 Mbps half duplex mode  
10F 10 Mbps full duplex mode  
100H 100 Mbps half duplex mode  
100F 100 Mbps full duplex mode

### **FLOW AUTO | ON / OFF**

Ethernet flow control:

AUTO Auto negotiation  
ON flow control enabled  
OFF flow control disabled

Flow control is implemented with PAUSE frames in full duplex mode and by backpressure (forcing collisions) in half duplex mode.

### **FLT ON / OFF**

Bridge filtering mode:

ON MAC address filtering enabled. Only broadcast packets and packets with destination addresses known to be on the Ethernet segment connected to the DSL will be forwarded to the DSL. The Bridge Filtering mode provides learning capacity of 8192 MAC addresses with an aging time of 3 minutes. Note that the Bridge Filtering mode of the Watson 5 Ethernet tabletop is unaware of VLAN tags.  
OFF filtering disabled. All Ethernet packets are transferred transparently to the DSL interface.

### **HDLCTAG ON / OFF**

ON Ethernet frames are transmitted over the DSL link with Cisco HDLC framing  
OFF Ethernet frames are transmitted with compressed HDLC framing. This setting must be used if the Watson 5 Ethernet tabletop is connected to the Watson 5 Ethernet plugin.  
Cf. chapter 3.2

## **7.1.6 Ethernet Bridging Configuration**

Ethernet bridging is only available on the Watson 5 Ethernet plugin.

### **AGING [ Time ]**

Defines the aging time for all entries in the address learning database of the Ethernet bridge.

#### **Parameter:**

Time Aging time in seconds (16 .. 4'000). Will be rounded to the next multiple of 16 seconds.

AGING without parameters will display the current aging time.

## **BRIDGEMODE [ Mode ]**

Sets the Ethernet bridge mode. Cf. 3.2.2

### **Parameter:**

- 1            Bridging is based on 802.1Q based VLAN tags
- 2            Transparent bridging
- 3            Bridging is port-based with support for inband management VLANs, cf. 3.5.5

BRIDGEMODE without parameter will display the currently active Bridgemode.

## **CONFIG ETHERNET *Ethernet-Port***

Shows the current configuration of an Ethernet port:

```
LTU_01_CM> CONFIG ETHERNET ETH1
~~~~~
Local Configuration of Bridges Ethernet Port ETH1
~~~~~
AutoNegFDX      : auto
FlowControl     : off
Doubletagging   : off
DefaultVlanId   : 1
DefaultPrio     : Q1
VlanList        : egress tagged   : -
                  egress untagged : 1
Loop            : Off
PrioSrc         : IEEE802.1Q
~~~~~
```

## **FLT [ ON / OFF ]**

Bridge filtering mode (global for the entire bridge):

- ON    MAC address filtering enabled. Only broadcast packets and packets with destination addresses known to be on the Ethernet segment of a port will be forwarded to this port. Address filtering is VLAN aware.
- OFF   MAC address filtering disabled. All Ethernet packets are transferred transparently to all Ethernet interfaces.

Typing FLT without argument displays the current configuration

## 7.1.7 VLAN Configuration

VLAN commands are available on the Watson 5 Ethernet plugin only.

### CONFIG VLAN

VLAN without parameters displays the current VLAN configuration:

```
LTU_01_CM> CONFIG VLAN
~~~~~
VLAN-Id  FID    ETH          DSL          MGMT  Name
          1* 2* 3* 4*    1* 2* 3* 4*    3*
~~~~~
      1    1    U    -    -    -    T    -    -    -    -    VLAN-1
      2    2    -    U    -    -    -    T    -    -    -    VLAN-2
      3    3    -    -    U    -    -    -    T    -    -    VLAN-3
      4    4    -    -    -    U    -    -    -    T    -    VLAN-4
    4094   16    -    -    -    -    -    -    -    -    U    VLAN-4094
~~~~~
Ports:          ETH1  ETH2  ETH3  ETH4  DSL1  DSL2  DSL3  DSL4  MGMT3
Default Vlan:          1      2      3      4      1      2      3      4    4094
Default Prio:          Q1    Q1    Q1    Q1    Q1    Q1    Q1    Q1    Q4
Doubletagging:    off    off    off    off    off    off    off    off
Bridgemode:          2 (Transparent VLAN)
~~~~~
```

#### Attributes:

VLAN-ID	VLAN Id
FID	Forwarding database used for this VLAN
ETH 1-4	- this port is not member of this VLAN
DSL 1-4	U this port is member of this VLAN, egress frames will be sent without VLAN tag
MGMT3	T this port is member of this VLAN, egress frames will be sent with VLAN tag
Ports marked with * do not use VLANs for switching, but are configured for transparent bridging.	
Name	Administrative name of this VLAN
Default VLAN	Default VLAN for this port
Default Prio	Default priority for this port
Doubletagging	Second VLAN tag will be added on egress
Bridgemode	Currently active Bridgemode

### **DEFAULTVLAN *Bridge-Port VLAN-ID Priority***

Sets the default VLAN ID and the default priority for untagged packets entering the plugin.

#### **Parameters:**

Bridge-Port	One of the bridge ports (ETH1 .. ETH4, DSL1 .. DSL4 , MGMT3)								
VLAN-ID	VLAN ID to add to all untagged packets entering at this port (1 .. 4094). Note that the Bridge-Port must also be member of this VLAN – otherwise all untagged packets will be discarded.								
Priority	Default priority to assign to all untagged packets entering at this port. Four priority levels (Q4, Q3, Q2, Q1) are supported. Q4 is the highest priority level.  If a VLAN tag is added to an Ethernet packet on egress then the priority levels are mapped to IEEE 802.1p bits as follows: <table> <tr> <td>Q4</td><td>110</td></tr> <tr> <td>Q3</td><td>100</td></tr> <tr> <td>Q2</td><td>010</td></tr> <tr> <td>Q1</td><td>000</td></tr> </table>	Q4	110	Q3	100	Q2	010	Q1	000
Q4	110								
Q3	100								
Q2	010								
Q1	000								

### **DOUBLETAGGING *Bridge-Port Direction***

Enables/disables double tagging (stacked VLAN operation) on a bridge port, cf. 3.2.4.

#### **Parameters:**

Bridge-Port	One of the bridge ports (ETH1 .. ETH4, DSL1 .. DSL4)								
Direction	<table> <tr> <td>OFF</td><td>Double tagging is disabled</td></tr> <tr> <td>IN</td><td>Double VLAN tags are expected on this port. The first (outer) VLAN tag will be removed before the packet is processed any further. If an incoming packet has a single tag then this tag will be removed. Untagged frames will not be modified.</td></tr> <tr> <td>OUT</td><td>An outer VLAN tag will be added to the packet sent over this port. Untagged packets will be sent tagged. Tagged packets will be sent double-tagged. The VLAN ID of the outer tag is defined by the default VLAN ID of the source port. The priority-bits of the extra tag are determined by the default priority of the ingress port. (DEFAULTVLAN command).</td></tr> <tr> <td>InAndOut</td><td>Combination of IN and OUT</td></tr> </table>	OFF	Double tagging is disabled	IN	Double VLAN tags are expected on this port. The first (outer) VLAN tag will be removed before the packet is processed any further. If an incoming packet has a single tag then this tag will be removed. Untagged frames will not be modified.	OUT	An outer VLAN tag will be added to the packet sent over this port. Untagged packets will be sent tagged. Tagged packets will be sent double-tagged. The VLAN ID of the outer tag is defined by the default VLAN ID of the source port. The priority-bits of the extra tag are determined by the default priority of the ingress port. (DEFAULTVLAN command).	InAndOut	Combination of IN and OUT
OFF	Double tagging is disabled								
IN	Double VLAN tags are expected on this port. The first (outer) VLAN tag will be removed before the packet is processed any further. If an incoming packet has a single tag then this tag will be removed. Untagged frames will not be modified.								
OUT	An outer VLAN tag will be added to the packet sent over this port. Untagged packets will be sent tagged. Tagged packets will be sent double-tagged. The VLAN ID of the outer tag is defined by the default VLAN ID of the source port. The priority-bits of the extra tag are determined by the default priority of the ingress port. (DEFAULTVLAN command).								
InAndOut	Combination of IN and OUT								



### **VLANADD VLAN-ID { Bridge-Port T / U }**

Adds a bridge port to a VLAN. A list of bridge-ports can be specified in a single command:

#### **Parameters:**

VLAN-ID	VLAN Id (1 .. 4094)
Bridge-Port	ETH1 .. ETH4, DSL1 .. DSL4, MGMT3
T	T Ethernet frames will be sent from this port with VLAN tags
U	U Ethernet frames will be sent from this port without VLAN tags

*Note*                *Never configure port MGMT3 with VLAN tags. The Watson 5 Ethernet plugin controller does not support tagged Ethernet packets..*

### **VLANCREATE VLAN-ID FID Administrative-Name**

Creates a new VLAN.

#### **Parameters:**

VLAN-ID	VLAN Id (1 .. 4094)
FID	Forwarding database to be used for this VLAN (0 .. 15).
Administrative-Name	An administrative name for this VLAN. Arbitrary text string.

### **VLANDEL VLAN-ID { Bridge-Port }**

Removes a bridge port from a VLAN. A list of bridge-ports can be specified in a single command:

#### **Parameters:**

VLAN-ID	VLAN Id (1 .. 4094)
Bridge-Port	ETH1 .. ETH4, DSL1 .. DSL4, MGMT3

### **VLANFID VLAN-ID Forwarding-Database-ID**

Changes the forwarding database of a VLAN

#### **Parameters:**

VLAN-ID	VLAN Id (1 .. 4094)
Forwarding-Database-ID	Forwarding database to be used for this VLAN (0 .. 15)

### **VLANNAME VLAN-ID Administrative-Name**

Changes the administrative name of a VLAN.

#### **Parameters:**

VLAN-ID	VLAN Id (1 .. 4094)
Administrative-Name	An administrative name for this VLAN. Arbitrary text string.

## **VLANREMOVE *VLAN-ID***

Removes all data configured for a particular VLAN. This command must be confirmed.

### **Parameter:**

*VLAN-ID*                      VLAN Id (1 .. 4094)

## **7.1.8 Class of Service Configuration**

Class of Service is available on the Watson 5 Ethernet plugin only.

### **PRIOSRC *Bridge-Port Priority-Source***

Determines how packets are prioritized by the bridge:

#### **Parameters:**

Bridge-Port	One of the bridge ports (ETH1 .. ETH4, DSL1 .. DSL4)
Priority-Source	Priority source. Possible values:
	IP                      Use the IP TOS/DSCP bits to determine priority
	IEEE                      Use the IEEE 802.1p priority bits to determine priority
	IPTHENIEEE              Use IP TOS/DSCP bits if present, IEEE 802.1p bits otherwise
	IEEEETHENIP             Use IEEE 802.1p bits if present, IP TOS/DSCP bits otherwise
	STATIC                      Ignore priority bits. Use the default priority for this port for all packets. The default priority is set with the DEFAULTVLAN command, cf. 7.1.7.

### **QMAP *Protocol-Layer Queue { Codepoint }***

Assigns Codepoints to priority queues. This command is global for all queues for all ports.

#### **Parameters:**

Protocol-Layer	IEEE    to classify according to IEEE 802.1p priority bits
	IP        To classify according to the IP TOS/DSCP field
Queue	Q1, Q2, Q3, Q4 . Q4 is the highest priority queue, Q1 has lowest priority
Codepoint	List of priority codes (0 .. 7 for IEEE classification, 0 .. 63 for IP classification).

Several Codepoints can be associated to a queue with a single command, e.g.

```
LTU_01_CM> QMAP IEEE Q2 3 4 5
```

results in all packets with IEEE 802.1p priority bit combinations 011, 100 and 101 to be sent to queue 2.

QMAP without parameters displays the current CoS configuration:

```
LTU_01_CM> QMAP
~~~~~
Bridge IEEE Priority Mapping
~~~~~
VLAN-Tag Prio:      0      1      2      3      4      5      6      7
Priority Queue:     Q2     Q1     Q1     Q2     Q3     Q3     Q4     Q4
~~~~~
Bridge DSCP Priority Mapping
~~~~~
DSCP Q | DSCP Q | DSCP Q | DSCP Q | DSCP Q | DSCP Q | DSCP Q | DSCP Q
~~~~~
0: Q1 | 1: Q1 | 2: Q1 | 3: Q1 | 4: Q1 | 5: Q1 | 6: Q1 | 7: Q1
8: Q1 | 9: Q1 | 10: Q1 | 11: Q1 | 12: Q1 | 13: Q1 | 14: Q1 | 15: Q1
16: Q2 | 17: Q2 | 18: Q2 | 19: Q2 | 20: Q2 | 21: Q2 | 22: Q2 | 23: Q2
24: Q2 | 25: Q2 | 26: Q2 | 27: Q2 | 28: Q2 | 29: Q2 | 30: Q2 | 31: Q2
32: Q3 | 33: Q3 | 34: Q3 | 35: Q3 | 36: Q3 | 37: Q3 | 38: Q3 | 39: Q3
40: Q3 | 41: Q3 | 42: Q3 | 43: Q3 | 44: Q3 | 45: Q3 | 46: Q3 | 47: Q3
48: Q4 | 49: Q4 | 50: Q4 | 51: Q4 | 52: Q4 | 53: Q4 | 54: Q4 | 55: Q4
56: Q4 | 57: Q4 | 58: Q4 | 59: Q4 | 60: Q4 | 61: Q4 | 62: Q4 | 63: Q4
~~~~~
```

**RATELIMIT** *Bridge-Port* [ *Direction* [ *Rate-Profile* / **OFF** ]]

Configures the rate limiter of a bridge port.

**Parameters:**

Bridge-Port	One of the bridge ports (ETH1 .. ETH4, DSL1 .. DSL4 , MGMT3)
Direction	IN (ingress rate limiters) or OUT (Egress rate limiter)
Rate-Profile	Rate limiter profile. A number between 1 and 56 for ingress rate limiting. A number between 2 and 8 for egress rate limiting. Cf. Table 3-4 and Table 3-5
OFF	Turns rate limiting off for this port.

RATELIMIT without parameters will display the current rate limiting configuration:

```
LTU_01_CM> RATELIMIT
~~~~~
Bridge Ethernet Port Ratelimits [kbit/s]
~~~~~
Ethernet Port      Q1      Q2      Q3      Q4      OUT
~~~~~
ETH1      not limited      -      -      -      not limited
ETH2      not limited      -      -      -      not limited
ETH3      not limited      -      -      -      not limited
ETH4      not limited      -      -      -      not limited
DSL1      not limited      -      -      -      2941
DSL2      not limited      -      -      -      5882
DSL3      not limited      -      -      -      5882
DSL4      not limited      -      -      -      5882
MGMT3     not limited      -      -      -      not limited
~~~~~
```

## **SCHEDULING Policy**

Determines the scheduling policy of all ports in the bridge.

### **Parameter:**

Policy	STRICT	Strict priority scheduling. Higher priority queues are emptied before any lower priority queue is processed. Note that strict priority scheduling can lead to starving of lower priority queues. Starving can be avoided either by rate limiting or by using WFQ scheduling.
	WFQ	Weighted fair queuing. Queues are emptied with weights 8:4:2:1 applied to the priorities.

SCHEDULING without parameters will display the currently active scheduling mode.

## **7.1.9 Management Configuration**

The management configuration commands allow you to set up the IP parameters required for management communications via Telnet or SNMP, cf. 0. They are available on the Watson 5 Ethernet plugin only.

### **CONFIG MGMT**

Displays the current configuration of management IP addresses:

```
LTU_01_CM> CONFIG MGMT
~~~~~
Management Configuration
~~~~~
IP-Address/Netmask      state  VID
Front    (MGMT1):      192.168.0.16/24    up
Backplane (MGMT2):      127.0.0.1/8        down
Bridge    (MGMT3):      192.168.0.1/24     up    4094

Masteragent      :  ON
MasterIP         :  127.0.0.1

RIPv2            :  OFF

Trap Destinations :
                  IP-Address  Port  Version  Community
                  192.168.0.107  162   v1       "traps"
~~~~~
```

### **GW IP-Address / DEL**

Sets the default gateway.

### **Parameter:**

IP-Address	IP address of the default gateway. Must be on the subnet of one of the management ports
DEL	Deletes the currently configured default gateway

## MASTERAGENT ON | OFF

Enables (ON) or disables (OFF) the SNMP Agent-X master agent function. Within one group of modems using Agent-X only ONE modem may be designated Master Agent (MASTERAGENT ON), all others must be designated as slave agents (MASTERAGENT OFF). All slave agents must have the IP address of the master agent properly configured (with the MASTERIP command). Cf. 8.1.1

## MASTERIP IP-Address

### Parameter:

IP-Address	IP address of the SNMP Agent-X master agent. The last part of the address can be replaced by the keyword #S to represent the subrack slot number where the card is inserted in. Factory default: 192.168.1.#S
------------	---

Plugins configured as Agent-X subagents (MASTERAGENT OFF) must know the IP address of the master agent. This is done with the MASTERIP command.

*Note*      *The plugin which is configured as master agent also contains subagents. It is required to configure a MASTERIP address on this plugin. Cf. 8.1.1*

## MGMTIP Management-Port IP-Address/Netmask [ State ]

Sets the IP address and netmask of a management port.

### Parameters:

Management-Port	One of the management ports (MGMT1, MGMT2 or MGMT3)
IP-Address/ Netmask	IP address and network mask for this port. Use the /nn notation for the network mask, e.g. 10.100.249.67/16. The last part of the address can be replaced by the keyword #S to represent the subrack slot number where the card is inserted in. Factory default: 192.168.0.#S/24 for MGMT1 192.168.1.#S/24 for MGMT2 Use address 0.0.0.0 to delete an address.
State	Status of the port (UP or DOWN)

*Note*      *The MGMTIP command is only available through the RS-232 Monitor interface, not through Telnet.*

## RIP ON | OFF

Enables/disables the Routing Information Protocol. The Watson 5 Ethernet plugin supports RIPv2 (RFC 1388). If RIP is enabled then there is no need to manually set up routes using the ROUTE command. The current setting of RIP is displayed with the CONFIG MGMT command.

*Notes*

- *There are no configurable parameters for RIP*
- *RIP is either active on all management ports (MGMT1, MGMT2 and MGMT3) or completely disabled.*

## **ROUTE [ ADD *IP-Address/Netmask Gateway* | DEL *IP-Address/Netmask* ]**

Adds or deletes a static route to the management routing table.

### **Parameters:**

ADD <i>IP-Address/Netmask Gateway</i>	Adds a route to the destination <i>IP-Address/Netmask</i> through the gateway <i>Gateway</i> .
DEL <i>IP-Address/Netmask</i>	Deletes a route to destination <i>IP-Address/Netmask</i>

ROUTE without parameters displays the routing table:

```
LTU_01_CM> ROUTE
~~~~~
Management Route Configuration
~~~~~
Destination      Mask           Gateway
10.101.0.0       255.255.0.0    10.100.249.1
~~~~~
```

## **SNMPCOMMUNITY [ READ | WRITE *Community-Name* ]**

Configures the SNMP read and write community strings. If the *Community-Name* is to include lowercase letters then it must be enclosed in quotes " " .

SNMPCOMMUNITY without parameters will display the currently configured community strings.

- Notes:
- This command is only available on the Masteragent (MASTERAGENT ON)
  - SNMP community strings are limited to 32 characters in length

## **SNMPTRAP ADD|DEL *Destination Port Version Community-Name***

Configures SNMP trap destinations.

### **Parameters:**

ADD	Add destination
DEL	Delete destination. To identify the destination to be deleted it is required to enter all trap parameters ( <i>Destination</i> , <i>Port</i> , <i>Version</i> and <i>Community-Name</i> )
<i>Destination</i>	IP - Address of the trap destination
<i>Port</i>	protocol port (default 162)
<i>Version</i>	SNMP version (v1 or v2, default is v1)
<i>Community-Name</i>	Trap community name (default is the currently configured SNMP read community).

It is possible to configure several trap destinations. Traps will be sent to all configured destinations. Use CONFIG MGMT to display the current list of trap destinations.

- Notes:
- This command is only available on the Masteragent (MASTERAGENT ON)
  - Trap community strings are limited to 32 characters in length

## 7.2 Fault and Maintenance Management FMM

### 7.2.1 Diagnostic

#### DIAGNOSTIC

The **DIAGNOSTIC** (or **DIA**) command shows the current DSL status. It is available from all menus by typing **DIA**.

```
LTU_01_FMM> DIA
```

Diagnostic:	SQ	Attn	PWR	Status	Alarms
DSL span 1					
STU-C A:	18	0	+13.5	Sync	LKINT
STU-R A:	14	0	+13.5	Sync	LKINT
DSL span 2					
STU-C A:	0	0	+13.5	Handshake	LOSW,LKINT
STU-R A:	--	--	--	Idle	---
DSL span 3					
STU-C A:	0	0	+13.5	Handshake	LOSW,LKINT
STU-R A:	--	--	--	Idle	---
DSL span 4					
STU-C A:	0	0	+13.5	Handshake	LOSW,LKINT
STU-R A:	--	--	--	Idle	---

On the tabletop the **DIA** display looks different:

```
NTU_FMM_REMOTE> DIA
```

Diagnostic:	SQ	G.826(ES)	Attn	Status	Alarms
NTU-A:	+18.5	00000000	+00.00	Sync	LKINT

After **DIA** the screen is continuously updated until the next monitor command is entered.

#### Attributes:

SQ	Signal Quality
G.826(ES)	G.826 errored seconds (only available on the Watson 5 Ethernet tabletop)
Attn	Link attenuation
PWR	Transmit power (only available on the Watson 5 Ethernet plugin)
Status	Synchronization status
Alarms	List of all active alarms

#### Note

A DSL master displays information both for the local and remote ends (STU-C and STU-R on the Watson 5 Ethernet plugin, LTU and NTU sides on the Watson 5 Ethernet tabletop).. DSL slaves display only local information.

## 7.2.2 Status (Plugin)

### STATUS

STATUS displays information about the status of the DSL spans.

```
LTU_01_CM> STATUS
~~~~~
SHDSL STATUS
Span          :          1          |          3          |
Name          :          UBS01      |          ETHZ       |
Pair          :          A          |          A          |
Wire Pair     :          ala2       |          b1b2       |
              :          B          |          clc2       |
              :          B          |          dld2       |
~~~~~
Admin. Status :          up        |          up        |
Master/Slave  :          Master    |          Master    |
Line Rate     :          2056 kb/s  |          0 kb/s    |
Payload Rate  :          4096 kb/s  |          0 kb/s    |
Transmission Mode:          ANNEX_B |          --        |
Remote Type   :          SZ.846.V450 |          SZ.846.V450 |
              :          Undefined |          Undefined |
~~~~~
```

#### Attributes:

Master/Slave	DSL Master or slave status
ActualPaylRate	Currently configured linerate
MaxAttnPaylRate	The maximum possible linerate
TransmissionMode	Current transmission mode (ANNEX_B for SDSL (TC-PAM 16), ANNEX_E for eSDSL (TC-PAM 32))
RemoteType	Type of modem connected at the far end

### STATUS ETH

STATUS ETH displays status information of the Ethernet bridge interfaces:

```
LTU_01_FMM> STATUS ETH
~~~~~
Status of the bridge's Ethernet interfaces
~~~~~
Port   AdminStatus  Mtu  OperStatus  Speed  Dup  Flow
~~~~~
ETH1   up            1536  down        0 b/s  auto auto
ETH2   up            1536  down        0 b/s  auto auto
ETH3   up            1536  down        0 b/s  auto auto
ETH4   up            1536  down        0 b/s  auto auto
DSL1   up            1536  up          100 Mb/s auto on
DSL2   up            1536  up          100 Mb/s auto on
DSL3   up            1536  up          100 Mb/s auto on
DSL4   up            1536  up          100 Mb/s auto on
MGMT3  up            1536  down        0 b/s  auto off
~~~~~
```



#### Attributes:

Port	The bridge port
AdminStatus	Administrative state
Mtu	Maximum frame size
OperStatus	Operating state
Speed	Interface speed. Note that for ports DSL1 .. DSL4 this is the internal speed between the Ethernet bridge and the DSL processor, not the DSL sync rate. Cf. Figure 3-4
Dup	Duplex mode
Flow	Flow control

## 7.2.3 Status (Tabletop)

The status of the tabletop is available with the following command

#### STATUS

```
NTU_FMM_REMOTE> STATUS
~~~~~
Local System Status                                     V2.1
~~~~~
SYNC-A: 02 OPS-A: 01 PID-A: 01 PWR-A: +08.50
~~~~~
```

#### Attributes:

SYNC		Status of SHDSL synchronization state machine according to TS 101 524.
	00	Out of Sync State
	01	State 0
	02	In Sync State
	03	State 1
	04	State 2
	05	State 3
	06	State 4
	07	State 5
OPS		Operational mode of the transceiver
	00	Idle Mode
	01	Data Mode
	10	Startup handshake in progress
	18	Startup training in progress
	80	Local analog loopback
PWR	n	Transmit power of each channel [dBm]

## STATUS ETH

This command displays the current status of the local Ethernet user interface. The status is determined by the results of the autonegotiation process and can differ from settings in the configuration menu.

```
NTU_FMM> STATUS ETH
~~~~~
Status of the Ethernet interface
~~~~~
Link      Speed    Duplex    Pause F.    Bridge Mode    Bit Rate
Up      100Mbit/s    Full      Possible    LAN <-> WAN    2048kbit
~~~~~
```

### Attributes:

Link	Ethernet link activity status. Up or Down
Speed	Ethernet interface band width
Duplex	Ethernet duplex operation mode (Monitor FDX command)
Pause F.	Fowl control operating mode (Monitor FLOW command)
Bridge Mode	normally LAN <-> WAN, in case of activated Loop1 => LAN loop
Bit Rate	Bit rate of the WAN side as set by the BITRATE command

## 7.2.4 Alarms

### ACO DSL-Link ON / OFF

The ACO (Alarm Cut Off) command enables or disables the alarm relays on the plugin for a particular DSL span. When ACO is 'on', alarms for this link will not be shown on the alarm relays. The local alarm LED signals a non-urgent alarm while ACO is active.

### ALARM T

The ALARM command displays the current alarm status:

```
LTU_01_FMM> ALARM
~~~~~
Alarm Status:
local
BER  LOSW  LKINT  LOOP
DSL1  off  off      off
DSL2  off  on       off
DSL3  off  on       off
DSL4  off  on       off
ETH1      on  off      off
ETH2      on  off      off
ETH3      on  off      off
ETH4      on  off      off
remote
BER  LOSW  LKINT  LOOP
DSL1  off  off      off
DSL2  -    -        -
DSL3  -    -        -
DSL4  -    -        -
ETH1      on  off      off
ETH2      -    -        -
ETH3      -    -        -
ETH4      -    -        -
ACO:
~~~~~
```

On the tabletop:

```
NTU_FMM_REMOTE> ALARM
~~~~~
Local Alarm Status
~~~~~
LOOP1:off  ACO:off  LKINT:on
LOOP2:off  ALB:off
LOSW-A:off BER-A:off SEG-A:off BERT:off
~~~~~
```

### Alarms (plugin):

BER	High bit error rate on DSL (CRC6 – faults)
LOSW	DSL loss of synchronization word
LKINT	Ethernet link integrity
LOOP	Test loop active

### Parameter:

T Turns alarm trace on / off. When **ALARM T** is active then each change in the alarm status will be shown on the screen with a time stamp counted in *min:sec:millisec* from the last system reset.

To deactivate alarm trace enter **ALARM T** a second time or leave the FMM menu.

### Alarms:

ACO	Alarm cutoff
ALB	Analog loopback (Watson 5 Ethernet tabletop only)
BER	
BER-A	SDSL block-error-rate according G.826 $\geq 30\%$
BER-B	
LKINT	Ethernet link integrity
LOOP	
LOOP1	Test loop active
LOOP2	
LOSW	
LOSW-A	DSL loss of synchronization word
LOSW-B	

## 7.2.5 Test loops

### **LOOP1 Ethernet-Port ON timeout / OFF**

The LOOP1 command controls the local loopback, cf. chapter 3.6:

The loop is automatically cleared after the timeout specified in the command (5 minutes in the example above). If no timeout value is specified then the loop will stay active until it is deactivated by a LOOP1 OFF command.

### **LOOP2 DSL-Port ON timeout / OFF**

The LOOP2 controls starts the remote loopback on a DSL port.

The loop is automatically cleared after the timeout specified in the command (5 minutes in the example above). If no timeout value is specified then the loop will stay active until it is deactivated by a LOOP2 OFF command.

Monitor LOOP2 commands. In case of remote Loop 2 requests, the master has higher priority than the slave.

#### *Notes:*

- *On the Watson 5 Ethernet tabletop modems it is not possible to specify an Ethernet or a DSL port.. LOOP1 loops the Ethernet port, LOOP2 the remote DSL port.*
- *On the Watson 5 Ethernet tabletop modems a loop timeout is not supported*
- *The LOOP2 command is not available on the Watson 5 Ethernet tabletop modem if it is configured as DSL slave*
- *Looped-back Ethernet packets egress the modems from the same port they were sent to and have the same source and destination addresses they were sent with. While Ethernet testing equipment can handle this situation it might be very confusing for "normal" Ethernet ports or Ethernet switches.*

## 7.2.6 Reset Commands

### **RESET**

Typing RESET on the Watson 5 Ethernet tabletop resets the modem.

### **RESET DSL-Port**

Typing RESET DSL-Port on the Watson 5 Ethernet plugin restarts a DSL link:

### **RESETCARD**

The RESETCARD command initiates a complete hardware and software reset of the Watson 5 Ethernet plugin. The RESETCARD command must be confirmed before it is processed.

#### *Note:*

*This command is not available on the Watson 5 Ethernet tabletop modem.*

## 7.3 Performance Management PM

### 7.3.1 G.826 Statistics

#### G826 DSL-Port [ C ]

The G826 command displays the ITU-T G.826 error performance parameters on the specified DSL port:

```
LTU_01_PM> G826 DSL1
~~~~~
SHDSL Performance Span 1 :      Pair-A
~~~~~
Errored Blocks           :      0
Errored Seconds          :      0
Severely Errored Seconds :      0
Available time           :      19
Unavailable time          :      0
~~~~~
```

On the Watson 5 Ethernet tabletop it is not required to specify a DSL port:

```
NTU_PM_REMOTE> G826
~~~~~
G.826 Error Performance :      CRC6 A
~~~~~
Errored blocks           : 00000002
Errored seconds          : 00000001
Severely errored seconds : 00000000
ESR [%]                  :      0.00
SESR [%]                 :      0.00
BBER [%]                 :      0.00
Available time           : 00339976
Unavailable time          : 00009044
~~~~~
```

#### Attributes:

Errored blocks	A block in which one or more bits are in error (CRC6 error)
Errored seconds	A one second period with one or more errored blocks
Severely errored seconds	A one second period which contains >=30% errored blocks
ESR [%]	Errored seconds to total sum of seconds ratio
SESR [%]	Severely errored seconds to total sum of seconds ratio
BBER [%]	Errored blocks to total sum of blocks ratio
Available time	Available time since last reset (modem reset or RESETG826)
Unavailable time	Unavailable time (errored seconds + severely errored seconds) since last reset

#### Parameter:

C	Continuously update the display.
---	----------------------------------

## RESETG826 *DSL-Port*

The RESETG826 command sets the G.826 values for a DSL port. On the Watson 5 Ethernet tabletop it is not required to specify a port.

```
LTU_01_PM> RESETG826 DSL1
G.826 error performance parameter reset for DSL1
```

## 7.3.2 Ethernet Statistics

### ETHERNET *Port* [ *C* ]

The ETHERNET command displays Ethernet statistics. It may be abbreviated to ETH. ETHERNET *Port* *C* updates the display continuously. For *Port* any of the external or internal Ethernet ports may be specified: ETH1 .. ETH4, DSL1 .. DSL4, MGMT2, cf. Table 6-1.

```
LTU_01_PM> ETHERNET ETH1
~~~~~
Statistics of the Ethernet Bridge Port ETH1
~~~~~
InDiscards      : 0
InErrors        : 0
InNUcastPkts    : 0
InOctets        : 0
InUcastPkts     : 0
OutDiscards     : 0
OutErrors       : 0
OutNUcastPkts   : 0
OutOctets       : 0
OutUcastPkts    : 0
~~~~~
```

#### Attributes:

InDiscards	Number of discarded packets during reception
InErrors	Number of errored packets received
InNUcastPkts	Number on non-unicast packet received
InOctets	Number of octets received
InUcastPkts	Number on unicast packets received
OutDiscards	Number of packets discarded during transmission
OutErrors	Number of packets sent with errors
OutNUcastPkts	Number on non-unicast packet sent
OutOctets	Number of octets sent
OutUcastPkts	Number on unicast packets sent

The Ethernet statistics for the Watson 5 Ethernet tabletop modem are somewhat different:

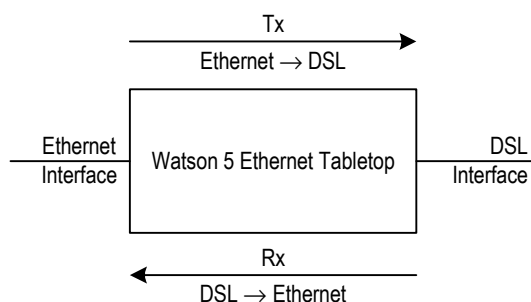
```
NTU_FMM> ETHERNET
~~~~~
Statistics of the Ethernet bridge
~~~~~
Controller          Frames          Errors
  HDLC Tx             0              0
  HDLC Rx             3              3
  MAC Tx              8              0
  MAC Rx              8              0
Interrupt event counter
  MAC Tx buffer full:                0
  MAC Rx collision retransmit:        0
Elapsed time (seconds):                3140
~~~~~
```

#### Attributes:

HDLC Tx	Number of Ethernet frames sent/errored frames on the DSL port
HDLC Rx	Number of Ethernet frames received/errored frames on the DSL port
MAC Tx	Number of Ethernet frames received/errored frames on the Ethernet port
MAC Rx	Number of Ethernet frames sent/errored frames on the Ethernet port
MAC Tx buffer full	Number of collisions on the Ethernet interface
MAC Rx collision retransmit	Number of transmit buffer overruns on the Ethernet interface

*Note:*

*Definition of Tx and Rx directions in the Watson 5 Ethernet tabletop modem:*



#### **RESETETH Port**

This command resets the Ethernet statistics for a particular port. On the Watson 5 Ethernet tabletop modem it is not required to specify a *Port* number.

## 7.4 Security and Remote Management SM

### 7.4.1 Connection control

#### **CONNECT DSL-Port**

The **CONNECT** (or **CON**) command establishes a connection over a DSL Port to a remote unit for configuration purposes. This connection uses the DSL EOC for communication.

#### **DISCONNECT**

The **DISCONNECT** (or **DIS**) command breaks the connection to the remote unit. In a modem chain the **DISCONNECT** command will disconnect one modem and connect to the previous modem in the chain, cf. 3.5.2.

To disconnect an entire chain at once you can type <ESC><ESC>

#### *Notes:*

- *Connection control commands are only available on modems that are configured as DSL master*
- *The **CONNECT** and **DISCONNECT** commands are available from all sub-menus, but are not displayed in the respective help screens.*

### 7.4.2 Inventory

#### **RCHM**

The **RCHM** command displays the CHM code of the connected device. The CHM code includes the hardware type identifier, information about hardware and software revisions as well as the default delivery settings.

#### **RFW**

The **RFW** command displays the firmware version of the connected device.

#### **RHM**

The **RHM** command displays the HM code of the connected device and displays it on the terminal.

The HM code includes the serial number of the device as well as information about manufacturer and warranty.



## 7.4.3 Password

### CHANGE PASSWORD

The `CHANGE PASSWORD` command is used to change a password. The old password has to be known to change it. The new password must be entered twice to confirm it.

```
NTU_SM> CHANGE PASSWORD
Old password: *****
New password: *****
Confirm new password: *****
52:11:40  new password set
```

### CLEAR PASSWORD

The `CLEAR PASSWORD` command clears the currently set password and disables password protection. This is the factory default setting.

```
NTU_SM> CLEAR PASSWORD
Old password: *****
Password cleared and Monitor protection disabled
```

### DSLSLAVE

The `DSLSLAVE` command is the only command allowed while password protection is active. The `DSLSLAVE` command is used to configure a master tabletop as a DSL slave to allow a remote terminal access in case the password of a master tabletop has to be changed or cleared.

```
Monitor Password Protection
Enter password: ***** (typed DSLSLAVE)
Device is now DSL slave
```

*Note: Through the remote terminal, i.e. through the DSL EOC the password commands are available without password protection. If a modem has been password protected and the password has been lost then it can be cleared again from modem configured as DSL master. If the modem who's password has been lost is configured as DSL master it can be set to DSL slave with the `DSLSLAVE` command that is available even while password protection is active.*

### LOGOFF

`LOGOFF` activates the password protected mode. The previously set password has to be entered before any new Monitor commands can be issued via the local terminal.

### SET PASSWORD

The `SET PASSWORD` command allows definition of a password on the tabletop. Once a password is set the modem will go into a protected mode either after the command `LOGOFF` is issued, after a timeout of 5 minutes or after a restart.

While in protected mode no Monitor command can be executed from a terminal connected to the local RS-232 port of the modem before the correct password has been given. All commands are still available on the remote terminal, i.e. through the DSL EOC. This allows somebody with access to an unprotected modem to reset the password of a protected modem.

Passwords are always displayed as a series of asterisks (\*) on the Monitor screen.

```
NTU_SM> SET PASSWORD
New password: *****
Confirm new password: *****
47:52:50 new password set and Monitor protection enabled
```

- Notes:
- Password protection is disabled by default
  - Firmware upgrades have no influence on the status of password protection, i.e. if a modem is password protected it will stay password protected after a firmware download
  - The password is not saved in cleartext in the modem configuration database.

## 7.4.4 Firmware Upgrade

### DOWNLOAD *DSL-Port IP-Address Package*

This command downloads a new firmware package through a DSL link into a Watson 5 Ethernet tabletop modem.

#### Parameters

<i>IP-Address</i>	IP address of the TFTP server where the new firmware package is stored
<i>Package</i>	Filename of the new firmware package

### UPDATE *Command*

This command loads new firmware into the Watson 5 Ethernet plugin using the TFTP protocol, cf. 3.3.

#### Parameters

INFO	Displays information about the currently installed firmware packages on the plugin.
GET <i>IP-Address Package</i>	Downloads a firmware package from a TFTP server . The TFTP server is specified by the <i>IP-Address</i> . On this server a firmware package with the name <i>Package</i> . SZU must be available.
COMMIT	Will activate the firmware package downloaded with GET and reboot the plugin
REVERT	Will revert to the old firmware package (i.e. that was active <i>before</i> the last GET) and reboot the plugin.
FORCE <i>IP-Address Package</i>	Downloads and commits a firmware package from a TFTP server. The TFTP server is specified by the <i>IP-Address</i> . On this server a firmware package with the name <i>Package</i> . SZU must be available.
UPDATE FORCE does not keep a backup of the old firmware package. The UPDATE COMMIT and UPDATE REVERT commands will fail after UPDATE FORCE.	

*Notes:*

- *Normally `UPDATE GET` should be used to upgrade the modem firmware. Use `UPDATE FORCE` only when instructed so by the firmware release notes or by Schmid Telecom Customer Support*
- *Do NOT disconnect the power supply from the Watson 5 Ethernet plugin modem while `UPDATE FORCE` is being executed.*



### 8.1 Introduction

The Watson 5 Ethernet plugin contains a built-in SNMP agent. The agent is accessible through the front-panel Q interface connector or through Ethernet inband management, either from an Ethernet user interface or over the DSL Ethernet payload, cf. 3.5.

The agent uses standardized Management Information Bases (MIBs) to represent the managed objects of the plugin, its interfaces, the DSL spans and the Ethernet bridging functions. All supported variables are listed in chapter 8.2.

The Watson 5 Ethernet tabletop modem when connected as DSL slave to a Watson 5 Ethernet plugin is manageable through the SNMP agent of the plugin. The tabletop modem is modeled with a vendor-specific MIB (Schmid Telecom HDSL MIB, cf. 8.2.12).

If two Watson 5 Ethernet plugin modems are connected back to back then each is managed by its own SNMP agent. In this situation the slave modem will normally use Ethernet inband management.

#### 8.1.1 AgentX

Several Watson 5 Ethernet plugin cards installed in the same subrack act as a single SNMP agent towards the management system. The agents on the individual plugins cooperate to form one common data structure of the management information available on each plugin.

Within a subrack SNMP functions are divided between

- a single processing entity called the master agent, which sends and receives SNMP protocol messages in an agent role
- several processing entities called subagents, which are "shielded" from the SNMP protocol messages processed by the master agent, but which have access to management information.

From the management systems point of view this combination of one master agent and several subagents behaves exactly as would a single agent that has access to the all management information within the subrack.

The communication between master agent and subagents uses the AgentX protocol which has been standardized as RFC 2741.

Subrack-wide information (e.g. inventory of subrack slots and the plugins contained in the slots) is handled by a rack agent. This rack agent is a subagent residing on the same plugin as the master agent.

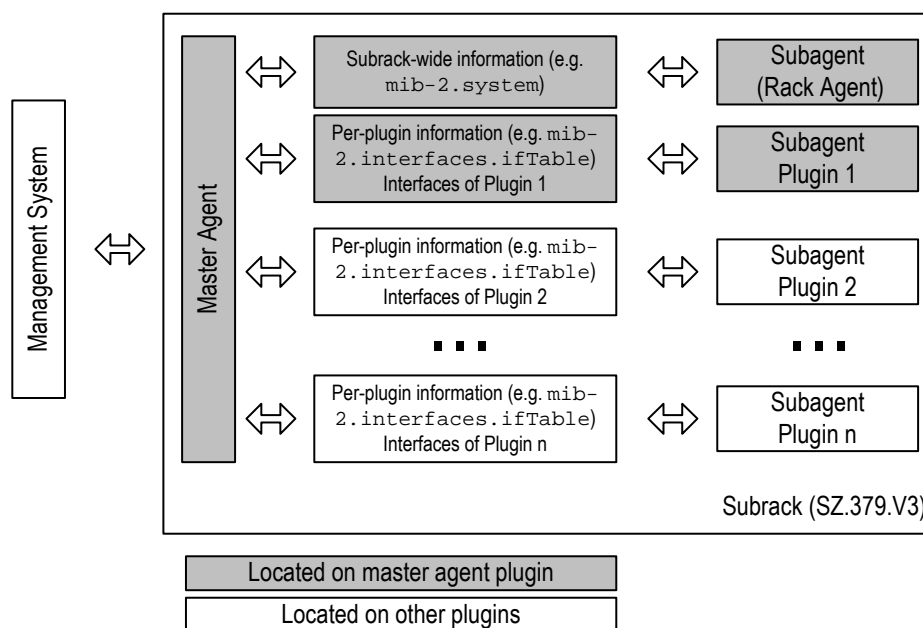


Figure 8-1: SNMP Master agent and subagents

## 8.1.2 SNMP Configuration

IP addresses and master agent behavior must be configured as follows:

- 1) One plugin in the subrack must be designated as master agent functions (Monitor command `MASTERAGENT ON`). This plugin communicates with the management system.
- 2) The `MASTERIP` address of the master agent plugin must be configured to the `MGMT2` address of this (i. e. the master agent) plugin.
- 3) The master agent function must be disabled on all other plugins in the subrack (Monitor command `MASTERAGENT OFF`).
- 4) The `MASTERIP` address of all other plugins must be configured to the `MGMT2` address of the master agent plugin.

## 8.1.3 The Entity MIB

A subrack is modeled with the Entity MIB (cf. 8.2.5) that describes the relation between subrack, plugins and ports. The `entPhysicalTable` and the `entAliasMappingTable` are used.

A subrack is represented by a single row in the `entPhysicalTable` with an `entPhysicalClass` of `chassis`.

Every slot in the subrack is represented by a row of the `entPhysicalTable` with an `entPhysicalClass` value `container`.

Every plugin is represented by a row of the `entPhysicalTable` with `entPhysicalClass` set to `module`. The column `entPhysicalParentRelPos` represents the slot number, column `entPhysicalContainedIn` gives the relation to the subrack.

Each port (DSL or Ethernet) is represented by a row of the `entPhysicalTable` with `entPhysicalClass` set to `port`. Column `entPhysicalParentRelPos` is the port number. Column `entPhysicalContainedIn` gives the relation to the plugin.

The `entAliasMappingTable` defines the relation between the ports and the `ifIndex` from the `ifTable` used in all other tables to index a port.

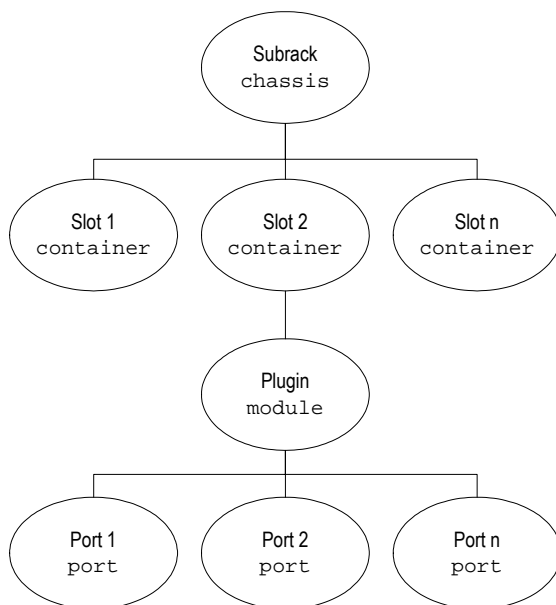


Figure 8-2 Entity MIB `entPhysicalTable`

There is one row in the `entLogicalTable` which describes the master agent. The relation between the master agent and its plugin card defined in the `entLPMappingTable`.

### 8.1.4 VLAN indexing

VLANs are controlled through various tables which are typically indexed by the VID of the VLAN, e.g. the `dot1qVlanIndex` which indexes the `dot1qVlanStaticTable`.

The management system sees one set of VLAN tables within a subrack. Internally each subagent handles a number of rows within these tables. Because each VLAN on each plugin can have any VID out of the possible range of 1 .. 4094 a VID cannot be guaranteed to be unique within a subrack.

To make the index into the VLAN tables unique an extended indexing scheme is used:

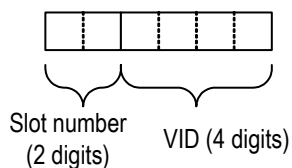


Figure 8-3: VLAN indexing

The first two digits of the index define the slot number, the following 4 digits define the VID.

Example: SNMP index = 102201 → plugin in slot 10, VLAN number 2201.

## 8.2 MIB Reference

The management information of the Watson 5 Ethernet plugin is modeled according to standardized MIBs. Additionally two vendor-specific MIBs are supported: the Schmid HDSL MIB to control the Watson 5 Ethernet tabletop modems and the Schmid MIB which contains a unique hardware identifier for the modems.

The following paragraphs document the supported MIB variables in a tree structure. For each variable its name, type, OID and `MAX-ACCESS` are given.

### 8.2.1 MIB II (RFC 1213)

MIB-II contains basic information about the system and its interfaces.

Implemented data structures:

- `system` group
- `ifTable`

Note that the Ethernet interfaces of the Watson 5 Ethernet tabletop modems are not visible in the `ifTable`.

### 8.2.2 Bridge-MIB (RFC 1493)

The Bridge MIB contains basic information about the Ethernet bridge of the Watson 5 Ethernet plugin card.

Implemented data structures:

- `dot1dBase` group
- `dot1dBasePortTable`
- `dot1dTp` group

### 8.2.3 P-BRIDGE-MIB (RFC 2674)

The P-Bridge-MIB controls behavior of the bridge layer 2 priority features (802.1p bits)

Implemented data structures:

- `dot1dExtBase` group
- `dot1dPortCapabilitiesTable` table
- `dot1dPortPriorityTable` table
- `dot1dTrafficClassTable` table



## 8.2.4 Q-Bridge-MIB (RFC 2674)

The Q-Bridge-MIB controls the VLAN functions of the Ethernet bridge of the Watson 5 Ethernet plugin modem. Note that the Q-Bridge-MIB only supports single VLAN tags.

Implemented data structures:

- `dot1qBase` group
- `dot1qVlanCurrentTable` (VLAN change history with `dot1qVlanTimeMark` is not supported. The object `dot1qVlanFdbId` is writeable and allows to define the FDB of this VLAN.)
- `dot1qVlanStaticTable`
- `dot1qPortVlanTable`

## 8.2.5 Entity MIB (RFC 2737)

The Entity MIB contains data structures modeling the subrack and the plugins in the subrack.

Implemented data structures:

- `entPhysicalTable`
- `entLogicalTable`
- `entLPMappingTable`
- `entAliasMappingTable`
- `entityGeneral` group

## 8.2.6 RMON (RFC 2819)

The RMON MIB contains Ethernet statistics counters.

Implemented data structures:

- `etherStatsTable`. The `etherStatsPkts1024to1518Octets` counter also counts packets from 1519 up to 1526 octets which is the maximum packet size supported by the Watson 5 Ethernet plugin card.

## 8.2.7 IF MIB (RFC 2863)

The Interfaces MIB contains a table of all interfaces of the Watson 5 Ethernet plugin card and the hierarchical relations between them. Note that the Ethernet interfaces of the Watson 5 Ethernet tabletop modems are not visible in the `ifTable`.

Implemented data structures:

- `ifTable`
- `ifStackTable`

## 8.2.8 SNMP Notification MIB (RFC 3413)

The SNMP Notification MIB allows to select groups of targets that are to receive notifications or traps. Each target is defined in the SNMP Target MIB.

Implemented data structures:

- `snmpNotifyTable`

## 8.2.9 SNMP Target MIB (RFC 3413)

The SNMP Target MIB allows for configuration of trap destinations.

Implemented data structures:

- `snmpTargetAddrTable`
- `snmpTargetParamsTable`

## 8.2.10 Etherlike MIB (RFC 3635)

The Etherlike – MIB manages flow control of the Ethernet interfaces (PAUSE frames).

Implemented data structures:

- `dot3ControlTable`
- `dot3PauseTable`

## 8.2.11 MAU MIB (RFC 3636)

The MAU MIB controls speed/duplex mode of the Ethernet interfaces and Autonegotiation.

Implemented data structures:

- `ifMauTable`
- `ifMauAutoNegTable`

## 8.2.12 HDSL2-SHDSL-LINE-MIB (RFC 4319)

The HDSL2-SHDSL Line MIB controls the DSL spans of the Watson 5 Ethernet plugin card.

The entire DSL span including both STU-C and STU-R ends is managed by the MIB which is accessible through the SNMP agent of the master (STU-C) modem.

DSL spans on the STU-C side are accessible in read-only mode through the SNMP agent of the STU-C..

Each DSL span has a single configuration profile and a single alarm profile. The profiles have fixed names of the format `Span xx Slot yy` where `yy` is the slot number in the subrack and `xx` is number of the DSL span (01 up to 04).

The `hds12ShdslSpanConfWireInterface` object can be used to disable a DSL span by setting it to 0, i. e. defining that the interface contains no wires.

Implemented data structures:

- `hds12ShdslSpanConfTable`
- `hds12ShdslSpanStatusTable`
- `hds12ShdslInventoryTable`

- `hdsl2ShdslEndpointCurrTable`
- `hdsl2ShdslEndpointMaintTable`
- `hdsl2ShdslUnitMaintTable`
- `hdsl2ShdslSpanConfProfileTable`
- `hdsl2ShdslEndpointAlarmConfProfileTable`

### 8.2.13 HDSL MIB

The HDSL MIB is a private MIB used to model the Watson 5 Ethernet tabletop modems. The variables of the HDSL MIB are available through the SNMP agent of the Watson 5 Ethernet plugin card connected to the tabletop.

Implemented data structures:

- `hdslNtuGenTable`
- `hdslNtuConfTable`
- `hdslNtuTestTable`
- `hdslNtuTestStPamTable`
- `hdslNtuTestBerPrbsTable`
- `hdslNtuTestEthStatTable`
- `hdslNtuLinParPamTable`
- `hdslNtuG826ResetTable`
- `hdslNtuG826LinATable`
- `hdslNtuG826LinBTable`

### 8.2.14 Schmid MIB

The Schmid MIB contains hardware identifiers (called the model codes) for Schmid DSL modems. The model code can be read as `sysObjectID` in the `system` group of `mib-2`.

Implemented data structures:

- `schmidGeneralWatsonModelCodes` group

### 8.2.15 Watson MIB

The Watson MIB contains vendor-specific data structures for Watson modems.

Implemented data structures:

- `watsonSpecificCardTable` to reset a Watson 5 Ethernet plugin card and to set the CoS scheduling policy
- `watsonSpecificIfConfTable` to configure interface-specific CoS features (Rate limiting, priority source)
- `watsonSpecificSpanConfTable` to configure specific DSL parameters (TC-PAM16/TC-PAM32)



### 9.1 Front Panel (Plugin)

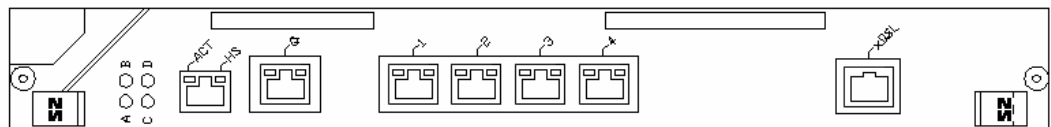


Figure 9-1: Plugin front panel

### 9.2 Rear Panel (Tabletop)

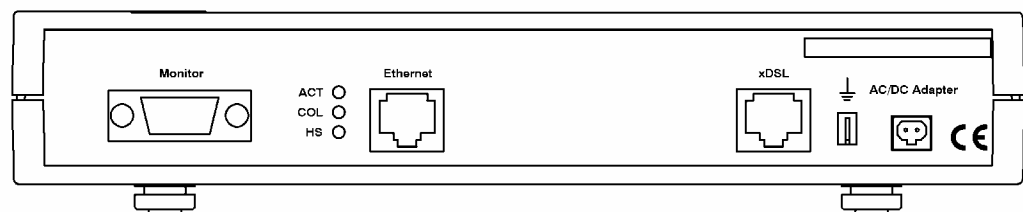


Figure 9-2: Tabletop rear panel

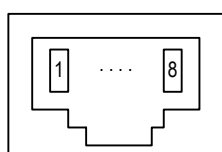


# 10 Connectors and Cables

## 10.1 DSL Interface

### 10.1.1 Connector

Connector Type RJ45-8



Front View

Figure 10-1: DSL Connector

The connector pin assignment for plugins is as shown below:

Pin	Signal	Description
1	d1	Wire pair d, tip
2	d2	Wire pair d, ring
3	b1	Wire pair b, tip
4	a1	Wire pair a, tip
5	a2	Wire pair a, ring
6	b2	Wire pair b, ring
7	c1	Wire pair c, tip
8	c2	Wire pair c, ring

Table 10-1: DSL connector pin assignment (Plugin)

On the Watson 5 Ethernet tabletop modem the pin assignment is as follows:

Pin	Signal	Description
1	NC	-
2	Shield	DSL cable shield (optional)
3	b1	Wire pair b, tip
4	a1	Wire pair a, tip
5	a2	Wire pair a, ring
6	b2	Wire pair b, ring
7	Shield	DSL cable shield (optional)
8	NC	-

Table 10-2: DSL connector pin assignment (Tabletop)

Pins 2 and 7 of the tabletop are connected to Functional Protective Earth (FPE). They can be used to connect the shield of the DSL cable or can be left open.

## 10.1.2 DSL Cable

SZ.378.0M0.V21: HDSL Cable, 4 pairs, 5m, open end

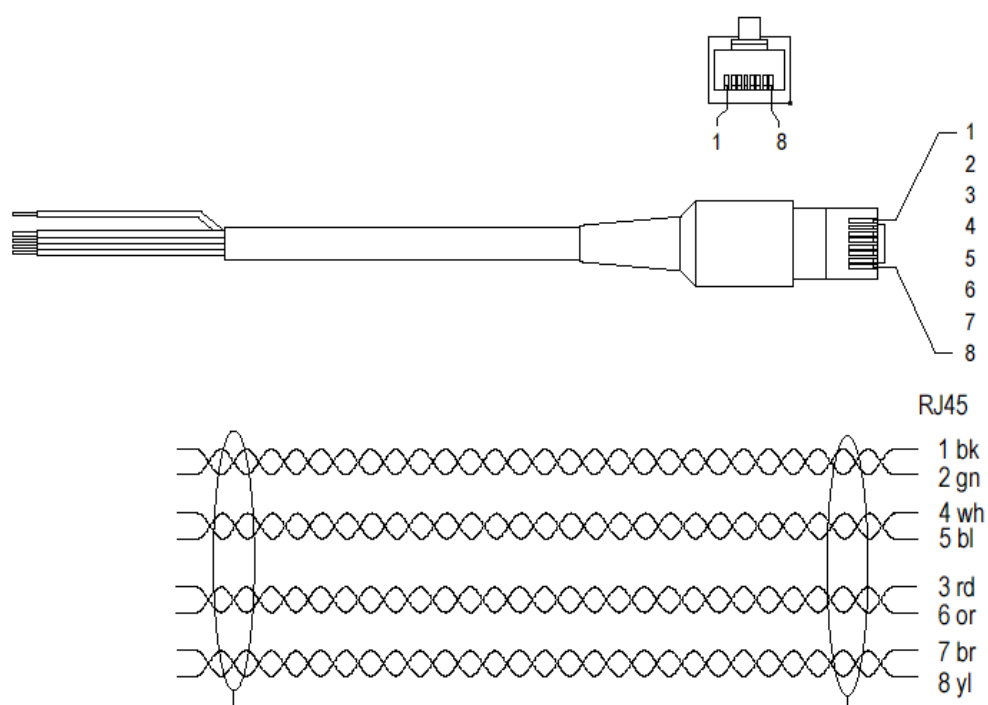
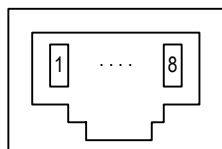


Figure 10-2: HDSL Cable, 4 pairs, 5m, open end



## 10.2 Ethernet Interface



Type: RJ45-8 (Front View)

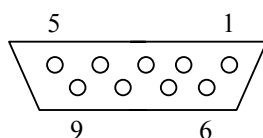
Figure 10-3: Ethernet Connector

Pin No	Signal Name
1	Transmit Data +
2	Transmit Data -
3	Receive Data +
4	Not used
5	Not used
6	Receive Data -
7	Not used
8	Not used

Table 10-3: Ethernet Connector

## 10.3 Monitor Interface

The Monitor connector is available on the tabletop, on the tabletop housing for plugins and on the ACU-2.



SubD9 female (Front View)

Figure 10-4: Monitor Connector

Pin	Signal	Description
1	SGND	RS-232 Signal Ground
2	TXD	RS-232 Transmit Data
3	RXD	RS-232 Receive Data
4	ALACOM	Common contact of Alarm relay
5	SGND	RS-232 Signal Ground
6	DA_NC	Urgent-Alarm contact, normally closed
7	DA_NO / CTS	Urgent-Alarm contact, normally open / RS-232 Clear to send
8	ND_NC / RTS	Non Urgent-Alarm contact, normally closed / RS-232 Ready to send
9	ND_NO	Non Urgent-Alarm contact, normally open

Table 10-4: Monitor Connector

## 10.4 Power and Grounding

### 10.4.1 Tabletop Power Connector

The tabletop power connector is designed for the power supply SZ.410.080.V1EA

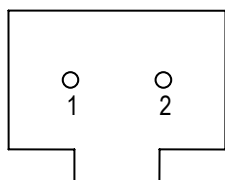


Figure 10-5: Power Connector

Pin	Signal	Description
1	+PWR	Positive power supply terminal
2	-PWR	Negative power supply terminal

Table 10-5: Power connector

### 10.4.2 Tabletop ground connector

The Watson 5 Ethernet Tabletops is fitted with a ground connector (FPE, Functional Protective Earth). The connector is normally covered by the rear panel of the housing. To get access to the connector a hole has to be cut in the rear panel around the indicated marks e.g. using a paper cutter.:

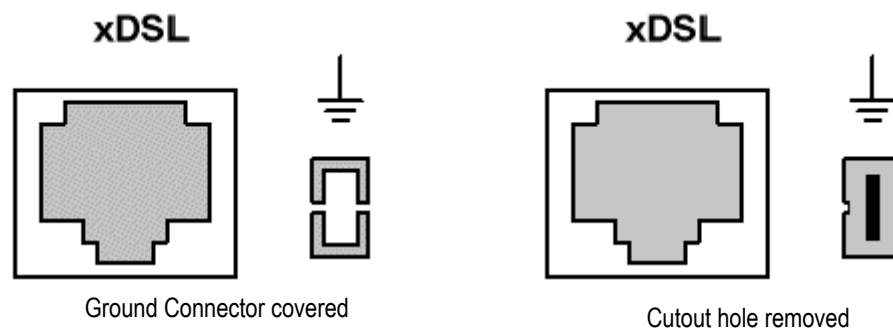


Figure 10-6: Ground Connector

The connector type is Faston 4.8 x 0.5 mm connector (DIN 46244) The hole in the rear panel is dimensioned for non-insulated Faston ferrules (DIN 46245).

## 11.1 Interfaces

### 11.1.1 DSL Line Interface

Standard referred:	ETSI TS 101 524, ITU-T G.991.2 Annex B (Revision 2004)
Number of Pairs:	1, 2 or 4
Line Rate per Pair:	200 – 5'704 kbit/s
Line Code:	Trellis-coded PAM-16, PAM-32
Nominal Line Impedance:	135 $\Omega$
Transmit Power @ 135 $\Omega$ :	According to TS 101 524
Overvoltage Protection:	plugin: ITU-T K.20: 2000 (K.44: 2000) tabletop: ITU-T K.21: 2000 (K.44: 2000)
Connector Type:	RJ-45, 8 pin
Wetting current source	2.7 mA @ 48VDC per pair (with 48VDC power supply and 0 Ohm loop resistance)
Wetting current sink	Plugin: 1.5 mA per pair (0 Ohm loop resistance) Tabletop: 0.25 mA per pair in 1-pair operation 0.125 mA per pair in 2-pair operation

### 11.1.2 Ethernet Interfaces

Standard referred:	IEEE 802.3
Crossover	Auto-Crossover
Bitrate	10/100 Mbps (Autonegotiation)
Duplex Mode	Half/Full Duplex (Autonegotiation)
Flow control	PAUSE Frames (full duplex) Backpressure (half duplex)

### 11.1.3 Monitor Interface

Signal Level:	RS-232
Data Rate:	9600 Baud, Asynchronous
Protocol:	8 Bit, No Parity, 1 Stop Bit No Linefeed with Carriage Return XON/XOFF enabled
Connector Type:	SubD9 female

## 11.2 Power Consumption

### 11.2.1 Plugin

Supply Voltage:	-40.5V <sub>DC</sub> .. -72V <sub>DC</sub>
Power Consumption:	9 W max

### 11.2.2 Tabletop

	Local Power Supply	Remote Power Supply
Supply Voltage	-40.5V <sub>DC</sub> .. -72V <sub>DC</sub>	-112V <sub>DC</sub> .. -65V <sub>DC</sub> at tabletop DSL-Connector
Power Consumption	SZ.846.V350	2.3 W max
	SZ.846.V450	3.5 W max

## 11.3 Ethernet

Maximum Frame Size	1'526 bytes
Number of MAC addresses	1'024
Number of address databases	15
Number of VLANs	64
Frame buffer size	120 Kbytes shared between all queues
Rate limiters	Configurable (128/256/512 Kbps and 1/2/4/8 Mbps)
Number of Queues	4 per port
CoS Classifiers	Layer 2 Priority Layer 3 DSCP

## 11.4 Latency and Throughput

These measurements are valid for the Watson 5 Ethernet plugin modem. They are measured between two Ethernet user interfaces of a modem pair connected through a DSL link.

		2'048 kbps	4'608 kbps	9'216 kbps	22'784 kbps
Packet Size	Latency	1.00 ms	0.80 ms	0.70 ms	0.70 ms
	Throughput	1.95 Mbps	4.40 Mbps	8.80 Mbps	21.7 Mbps
64 Byte	Latency	3.00 ms	1.80 ms	1.30 ms	1.00 ms
	Throughput	2.00 Mbps	4.55 Mbps	9.10 Mbps	22.60 Mbps
512 Byte	Latency	7.10 ms	3.80 ms	2.40 ms	1.60 ms
	Throughput	2.00 Mbps	4.60 Mbps	9.20 Mbps	22.70 Mbps

## 11.5 Management Functions

Management Protocols	SNMPv1 (RFC 1157), Agent-X (RFC 2741) Telnet (RFC 854)
Supported MIBs	MIB II (RFC 1213) Bridge-MIB (RFC 1493) P-BRIDGE-MIB, Q-Bridge-MIB (RFC 2674) Entity MIB (RFC 2737) RMON (RFC 2819) Interfaces MIB (RFC 2863) SNMP Target MIB (RFC 3413) SNMP Notification MIB (RFC 3413) HDSL2-SHDSL-LINE-MIB (RFC 4319) Etherlike-MIB (RFC 3635) MAU MIB (RFC 3636) HDSL Private MIB Schmid Private MIB
Firmware Upgrade	TFTP (RFC 783)

## 11.6 MTBF

Modem Type	MTBF
SZ.846.V350	84 years
SZ.846.V450	56 years
SZ.866.V654	39 years

## 11.7 Environment

### 11.7.1 Climatic Conditions (Plugin and Tabletop)

Storage:	ETS 300 019-1-1 Class 1.2	-25°C ... +55°C, 10% .. 100% RH
Transportation:	ETS 300 019-1-2 Class 2.3	-40°C ... +70°C, max. 95% RH
Operation:	ETS 300 019-1-3 Class 3.2e	-5°C ... +60°C, 5% .. 95% RH

### 11.7.2 Safety

According to EN 60950:2000 (IEC60950:1999)

### 11.7.3 EMC

According to EN 300386:2000

## 11.8 Physical dimensions and weight

### 11.8.1 Plugin

19" Plugin unit: height: 259mm (6 HE), width: 30mm

PCB dimensions: height: 233.35mm, length: 220mm

Weight 500g

### 11.8.2 Tabletop

Tabletop unit: width 220mm, depth 195mm, height 43mm

Weight 750g

## 12 Terminology

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Throughout this document the following terminology is used:

Term	Meaning
CoS	Class of Service
DSCP	Differentiated Services Code Point. Code contained in the IP header used to determine the priority of IP packets.
DSL Linerate	Data rate of a DSL span available to the application
DSL Link	Synonymous for DSL Span
DSL Master	Synonymous for STU-C
DSL Payload rate	Synonymous to DSL Linerate
DSL Slave	Synonymous for STU-R
DSL Span	Connection between STU-C and STU-R, composed of one or more wire pairs.
DSL Sync rate	Physical synchronization rate of a DSL wire pair
EOC	Embedded Operations Channel, an overhead channel available in SHDSL for management purposes
Linerate	cf. DSL Linerate
LTU	Line Termination Unit, functionally equivalent to STU-C
NTU	Network Termination Unit, functionally equivalent to STU-R
Payload rate	Synonymous to linerate
STU-C	Synchronous Terminal Unit – Central Office Side. The end of a DSL link that starts up and controls the link. Typically installed at the central office
STU-R	Synchronous Terminal Unit – Remote Side. The end of a DSL link that is controlled by the STU-C. Typically installed at the customer premises
Sync rate	Cf. DSL Sync rate
VID	Virtual LAN Identifier, a.k.a "VLAN Number". The unique identifier of a VLAN. Carried in the VLAN Tag of an Ethernet frame.
VLAN	Virtual LAN (IEEE 802.1q)