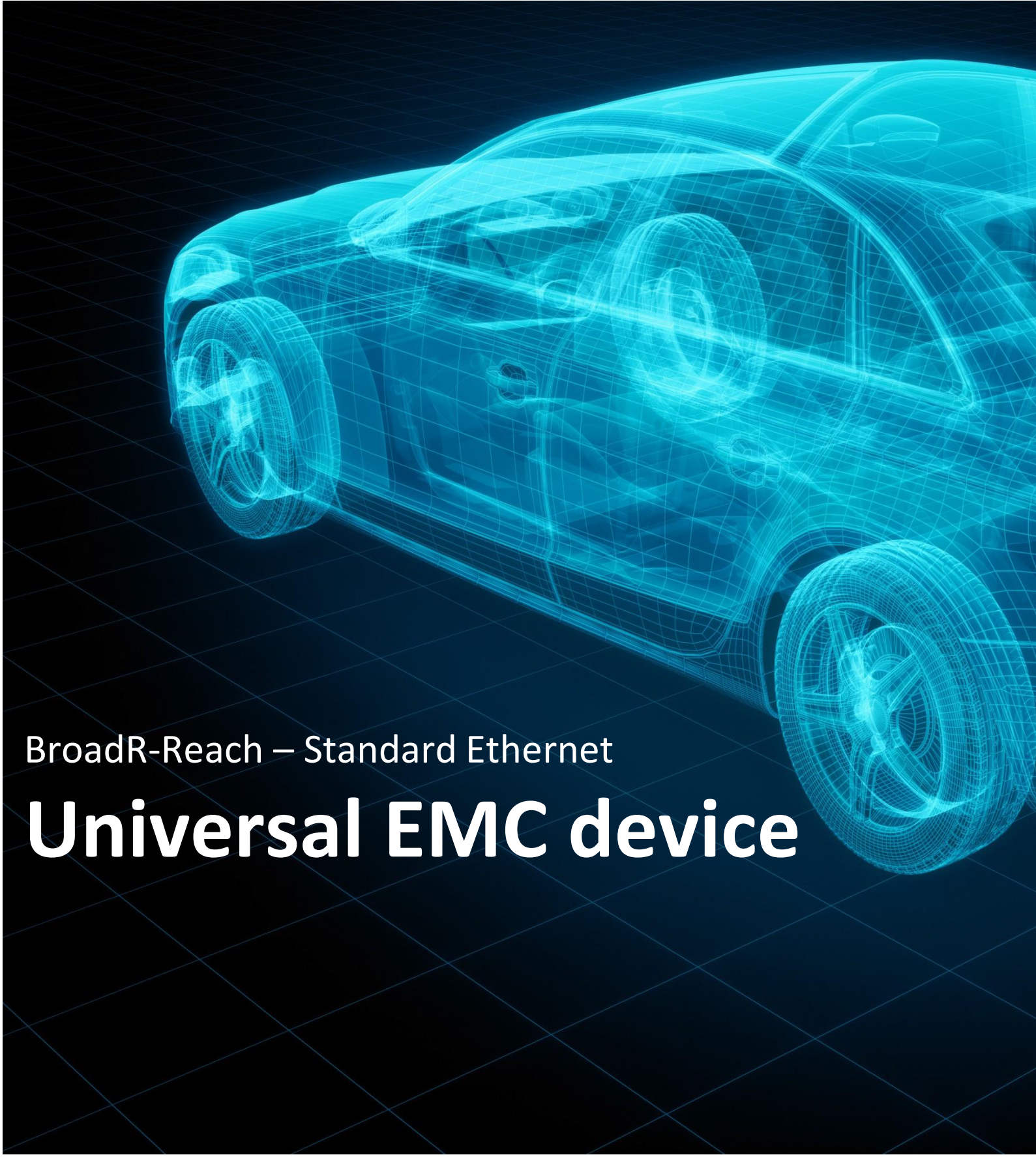


BroadR-Reach – Standard Ethernet

Universal EMC device

User Manual

October 2017

technica engineering

Changelog

Release Notes – Universal EMC device - Version 0.1
Release Notes – Universal EMC device - Version 1.0

Contents

1. Feature List

The Technica Engineering Universal EMC device has the following basic features:

4 Ports Broadcom BroadR-Reach
100 MBit/s Fullduplex on a single unshielded twisted pair

2 Ports Gigabit Ethernet SFP module socket

1 Port Fast Ethernet OBD

- ✓ Broadcom BroadR-Reach Technology
- ✓ Tyco MQS Connectors for BroadR-Reach and Power Supply
- ✓ Webserver for easy configuration:
  - Master / Slave
  - Port Mirroring
  - VLAN Tagging
  - Port Status Display
- ✓ Import and Export of Configurations
- ✓ WakeUp functionality
- ✓ CAN, LIN and FlexRay interfaces
- ✓ Power output for attached devices: V_{BAT} max. 1,2 Ampere in total (Fused)
- ✓ Possibility to reset to default settings by pushbutton
- ✓ Robust steel case

Power requirement:	7 to 16 Volt DC (nominal 12 Volt DC) Power consumption: 7 to 12 Watt
Size:	14 x 13,5 x 3,2 cm
Weight:	0,5 kg
International Protection:	IP 2 0
Operating Temperature:	-40 to +80 °Celsius

2. Warranty and Safety Information

Before operating the device, read this manual thoroughly and retain it for the userr reference.

Use the device only as described in this manual. Use only in dry conditions.
Do not apply power to a damaged device.

Do not open the device. Otherwise warranty will be lost.

This device is designed for engineering purpose only. Special care should be taken for operation.
Do not use this device in a series production car.
As this device is likely to be used under rough conditions, warranty is limited to 1 year.
Manufacturer liability for damage caused by using the device is excluded.

3. Pinning

The pinning of the ECU connectors is listed on the label on top of the device. The Tyco Electronics (TE) Micro Quad Lock System (MQS) is used.

Name	Type	Part Number
Tyco, MQS Abdeckkappe	2x9 Pol, black	1-967416-1
	Alternatively	1-1355350-1
Tyco, MQS Abdeckkappe	2x9 Pol, blue	3-967416-1
Tyco, MQS Buchsenge-häuse	2x9 Pol	965778-1
	Alternatively	962108-2
Tyco crimp contact		928999-1

Note: The user can use the official Tyco tool for these crimp contacts. A cheap variant is the crimp tool for “PSK” contacts.

Power connector (top left)

Connector color: Black

The power for the device is supplied by Pin 1 (12Volt) and Pin 2 (Ground). Requirements for the Universal EMC device itself: 12 Volt DC up to 1 Ampere (typical 600mA)

Warning: If the user applies a voltage higher than 16 Volt, the device **will be damaged**!

The LIN interface can be used to communicate with the Microcontroller by LIN bus. In the default software, there is no data transmission specified.

The FlexRay interface can be used to communicate with the Microcontroller by FlexRay bus. In the default software, there is no data transmission specified. This interface may only be used in customer specific software.

Pin	Function	Pin	Function
1	Battery +12 Volt Input	10	Wake Line 3 (Output only)
2	Ground Input	11	Ground Input
3	Analog input	12	Digital output
4	Digital input	13	LIN Master
5	Not connected	14	LIN Slave
6	FlexRay Channel A P	15	FlexRay Channel A P
7	FlexRay Channel A M	16	FlexRay Channel A M
8	CAN 1 P	17	CAN 2 M
9	CAN 1 M	18	CAN 2 P

Switch connectors

Connector color: Blue

The pins marked with (P) or (N) are used for the BroadR-Reach ports. Four ports are available. The user must connect the (P) pin to the (P) pin of the periphery device. The user must connect the (N) pin to the (N) pin of the periphery device.

Note: If the user swaps these two pins the link LED may be lit on the BroadR-Reach slave side, but no data transmission will be possible.

Connector 1:

Pin	Function	Pin	Function
1	CAN 4 P	**10**	CAN 3 M
2	CAN 4 M	**11**	CAN 3 P
3	CAN 5 P	**12**	Not connected
4	CAN 5 P	**13**	Not connected
5	Ground Input	**14**	Ground Input
6	CAN 6 P	**15**	Not connected
7	CAN 6 M	**16**	Not connected
8	Fast Eth (OBD) Rx M	**17**	Fast Eth (OBD) Tx M
9	Fast Eth (OBD) Rx P	**18**	Fast Eth (OBD) Tx P

Connector 2:

Pin	Function	Pin	Function
1	BroadR-Reach 4 M	**10**	BroadR-Reach 4 M
2	BroadR-Reach 4 P	**11**	BroadR-Reach 4 P
3	Not connected	**12**	Not connected
4	Not connected	**13**	Not connected
5	Ground Input	**14**	Ground Input
6	Not connected	**15**	Not connected
7	Not connected	**16**	Not connected
8	BroadR-Reach 1 P	**17**	BroadR-Reach 2 P
9	BroadR-Reach 1 M	**18**	BroadR-Reach 2 M

SFP slot

There are two SFP cages for a MiniGBIC module.

LEDs

The “Host” LED can toggle at three different speeds:

- Slow toggle (approx. 0.5 sec) during normal operation to show that the microcontroller is running in normal mode.
- Fast toggle (approx. 0.1 sec) when the microcontroller is in bootloader mode. The bootloader mode is used for firmware update only (see below in this manual). The user cannot access the web- site when the device is in bootloader mode.
- When the device is in Bootloader-Update Mode the LED toggles with moderate frequency (cca. 0.25 sec).

Note: When the P-M lines from a bus the port status LED may be on in this case on BroadR-Reach slave side, but there will be no data transmission possible.

Push button

The *Pushbutton* on the left side of the case will reset all settings to factory default.

Pressing this button down for 5~6 seconds with a pen when the Host Led is blinking normally:

- IP Address will be reset to default (192.168.0.49)
- All settings will be lost.

Note: If the device is blocked and all LEDs are lit, device must be sent to Technica Engineering.

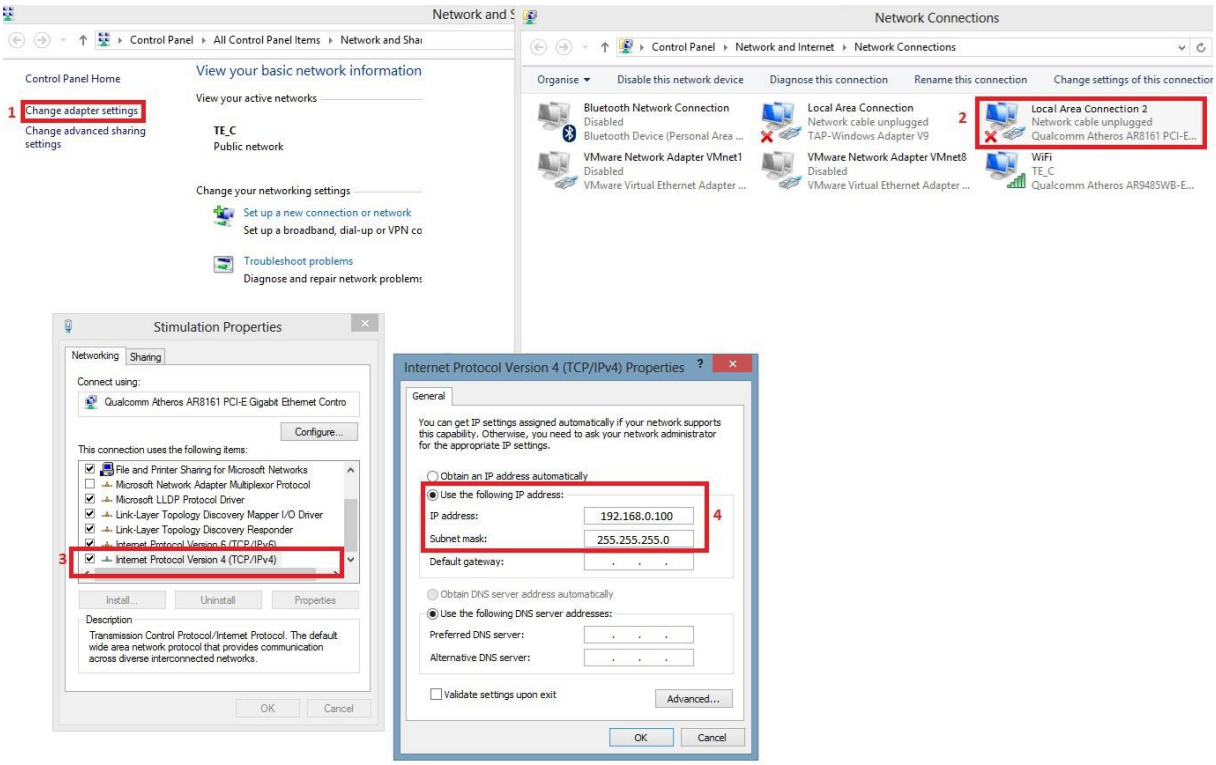
Note: MAC Address will not be changed.

4. Website Configurations

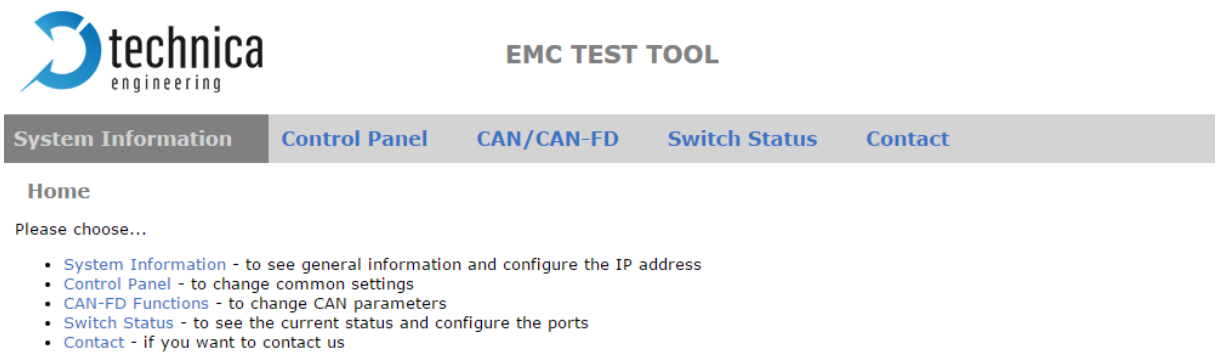
The user can access the configuration website with a standard web browser.

The default IP address of the device is 192.168.0.49 and subnet mask 255.255.255.0
If IP address has been changed, the user can reset it to default as described in Chapter 4 of this manual.

For example, set the configuration PC to IP address 192.168.0.100 and subnet mask to 255.255.255.0

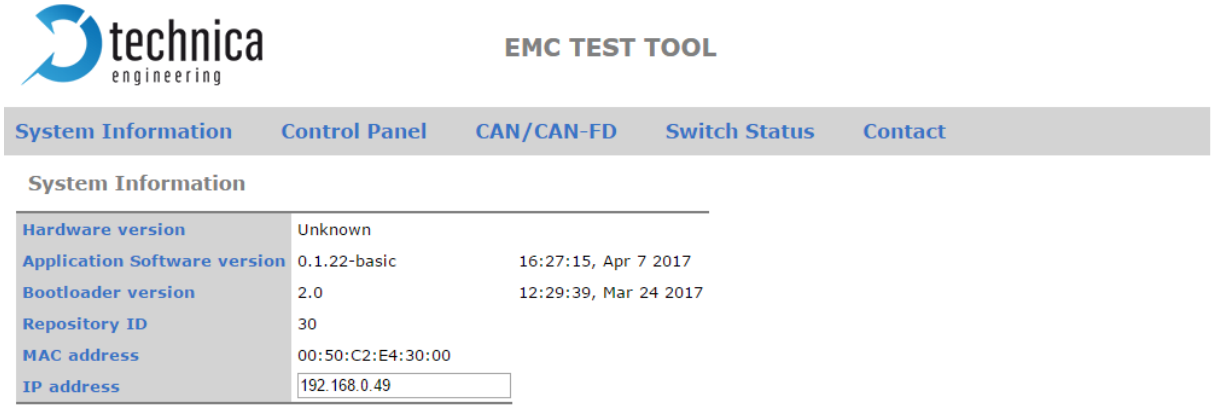


Website Home



Warning: If there is a lot of *broadcast traffic* on the switch, the host microcontroller may be jammed. The user cannot access the website in this case. Please use VLAN configuration to forward only relevant messages to the microcontroller.

With the first access to the website the user will get the home screen. Please select one of the tabs for further configuration.



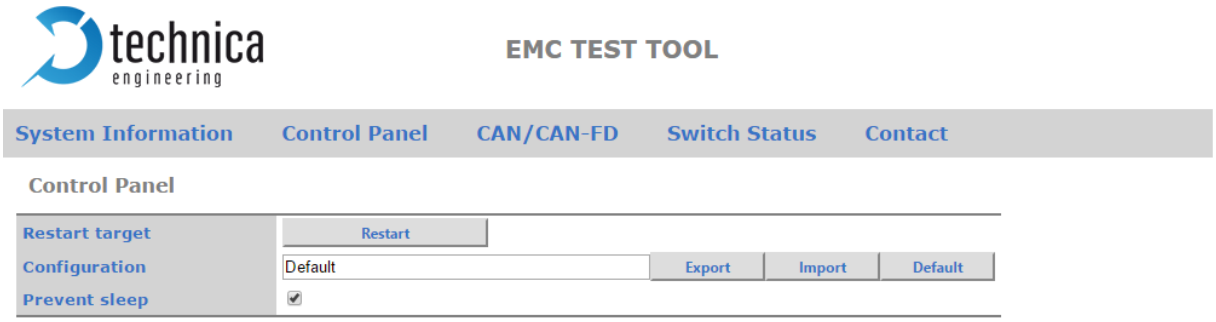
System Information Tab

On the tab „System Information“ some status information about the device is displayed. The user can check the version number of the application firmware and the bootloader or the unique MAC address of the device.
The MAC address should be the same as on the label on the bottom of the device.

The user can change the IP address of the host microcontroller (Webserver) here. If the user wants to use multiple devices in one network, an unique IP for each device shall be set.

Note: If someone has changed the IP address the user can reset it to default as described in Chapter 4 of this manual.

Control Panel Tab



On the „Control Panel“ tab the user can soft-reset (restart) the system.

Also, the user can import or export the configuration settings of the device to a file (*.cfg) on a computer connected to the SFP Port. The user must restart the device for usage of the new configuration.

The user can reset the configuration settings to default. All the configuration stored will be revert to its defaults values. IP address will be not modified.

If the user does not want to use a WakeUp line or the CAN bus wake-up, “Prevent sleep” checkbox can be enabled. This will keep the device running without entering the sleep mode.

If the user enables “Diagnose Service”[1] functionality, Universal EMC device will send periodically information status about its state. For example, transmitted and dropped frame counters.
For more details about the format of these frames see the Fibex File (and .pdf description) in the firmware release files.
Fibex File can be loaded in ANDi Tool to dissect the frame contents.

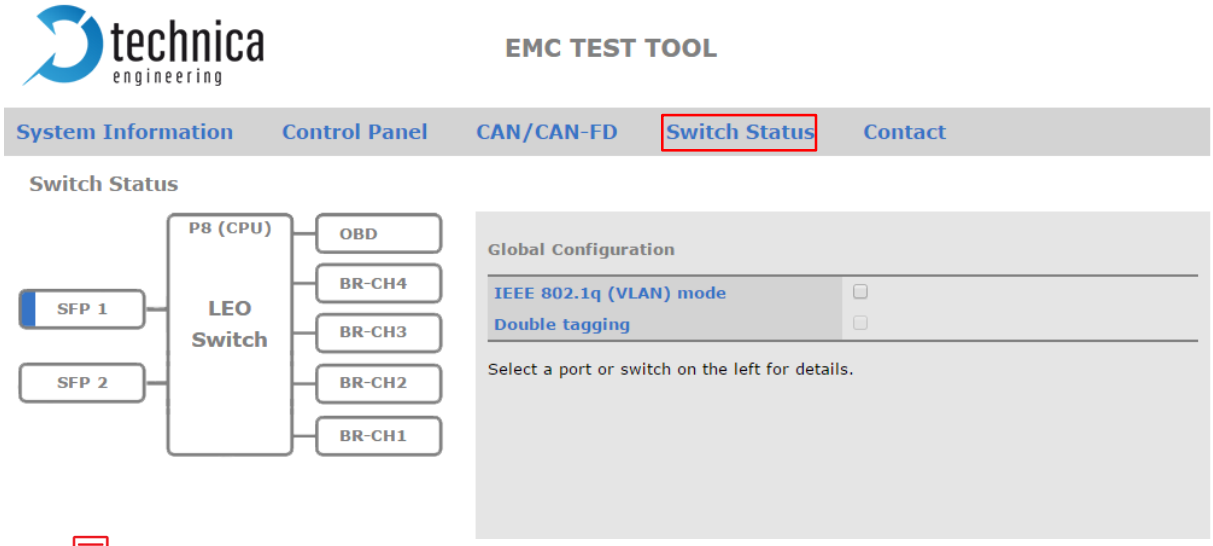
Switch Status Tab

The main configuration of the switch is done in the „Switch Status“ tab.
Here the user can configure details about each port and get status information about the ports and switch states.

On the left side of the page the user can see an overview of all available ports. A blue bar at the side of a port label indicates an active link.

Global Configuration

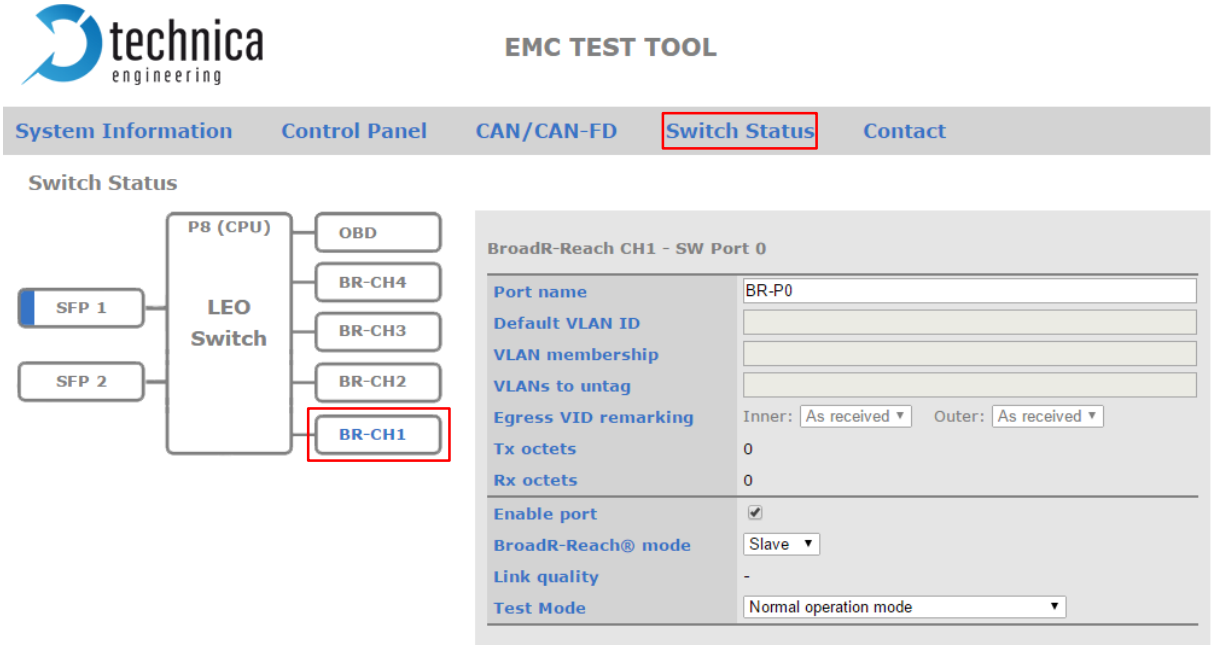
When clicking on „Switch Status“ tab and no port is selected, *Global configuration* will appear.
Here it is possible to activate *Single* or *Double VLAN tagging*[2].



[2] **Note**: For more information about VLAN configuration in chapter 6.

Switch Port details

When selecting a specific port, all its informations and configuration possibilities will appear.



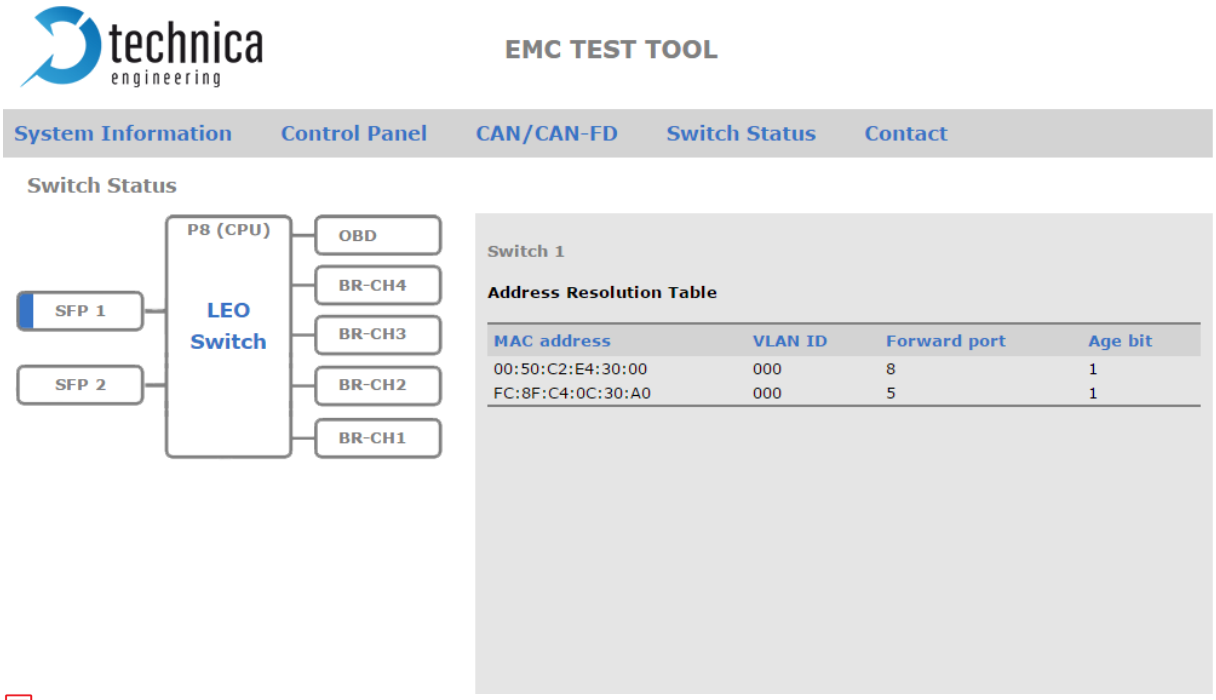
ARL Table status

When the user click on the switch label the Address Resolution Table of this switch will be displayed for the user information.
ARL table is filled dynamically. It shows the learned MAC addresses, VLAN ID, Forward port and Age Bit.

Note: *Age Bit indicates if ARL entry is active.*

In next example we see that Switch 1 has learned two ARL Entries:

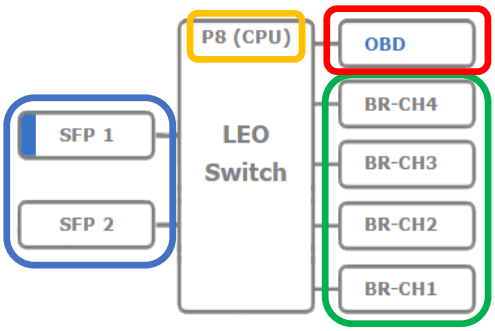
1) MAC Address *00:50:C2:E4:30:00* is reachable through *port 8* *without* using VLAN.
2) MAC Address *FC:8F:C4:0C:30:A0* is reachable through *port 5* *without* using VLAN.



NOTE: When *IEEE 802.1q (VLAN) mode* is disabled, VLAN will be *0x000.*

Ports

The Universal EMC device has 4 kinds of ports. A total of 8 configurable ports.



BroadR-Reach Ports	4 Ports => 100 Mbps
SFP Module Port	2 Ports => 10/100/1000 Mbps
Internal Ports *P8*(CPU)	1 Port => 10/100/1000 Mbps
OBD	1 Port

- The Microcontroller is connected to a 100 MBit/s link to P8 (CPU).
- The user can connect to the PC using the two SFP modules or the OBD port

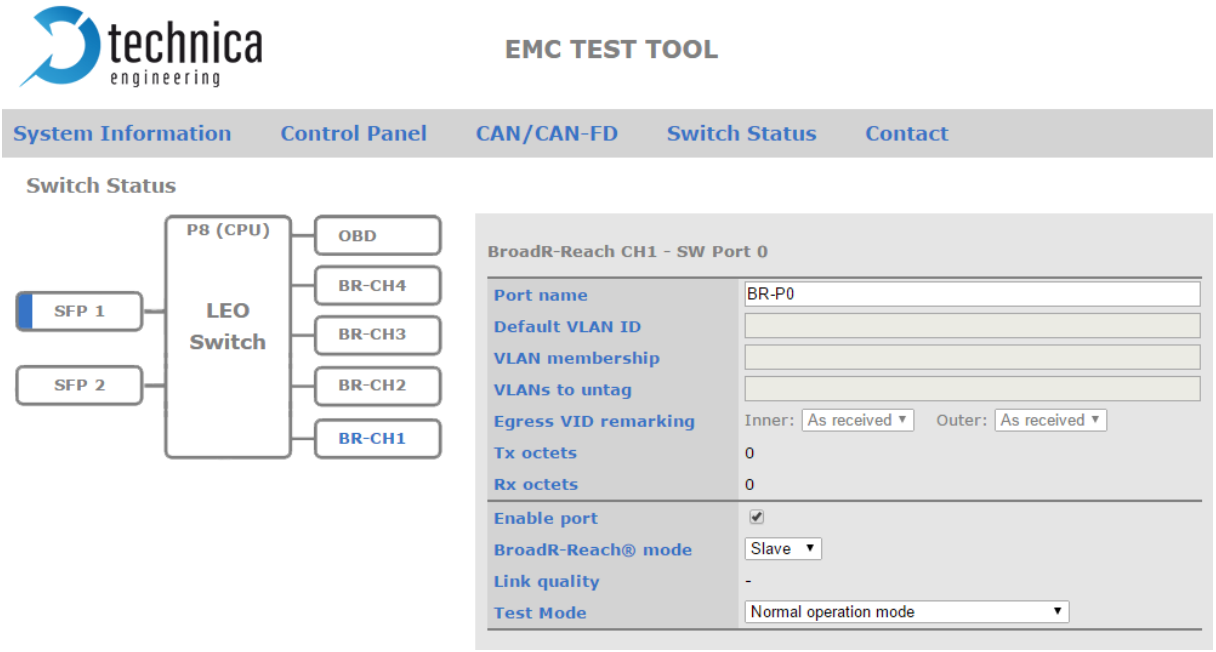
The following proprieties are present to all the ports:

Port Name	Description label will give a better information. (*Config-PC, Datalogger, etc.*)
Default VLAN ID	Port will use this identifier per default
VLAN membership	Port will be member of this list of VLANs
VLANs to untag	Port will untag packet
Egress VID remarking	Port can modify the inner/outer VLAN at egress.
TX Octets	Tx octets status counter for the outgoing bytes of this port.
Rx Octets	Rx octets status counter for the incoming bytes of this port.
Inner VLAN IDs:	Port will drop packets with single tag specified
Source IP	Port will drop packets with specified source IP address
Destination IP	Port will drop packets with specified destination IP address

Some other fields are *port dependent* and will be discussed in following sections.

Note: *More information about VLANs will be described in chapter 6.*

BroadR-Reach Port



Besides the common fields to all ports, *BroadR-Reach* ports allows the user to:

- **Enable port:** With this checkbox, the BroadR-Reach ports can be enabled or completely disabled.

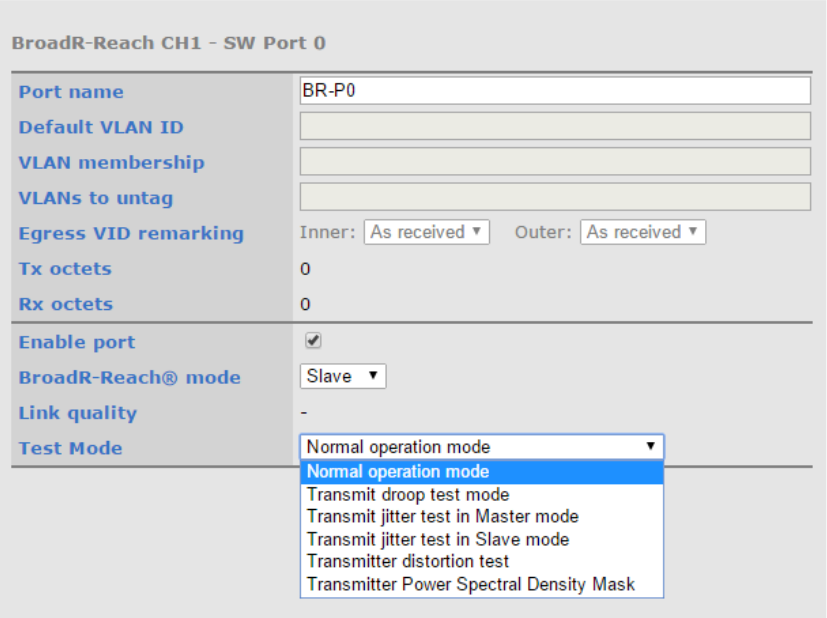
  Note: If port is disabled and cable is still connected, LED status for this port will be lit but no data is sent or received. Webpage will show the linkup.

- **BroadR-Reach mode:** On each BroadR-Reach link there must be one *master* and one *slave* device.

  Please set the "BroadR-Reach mode" to the opposite of what the device is set the user have connected to this port.

- **Link Quality:** The "link quality" is an indicator about the signal integrity of the BroadR-Reach link on this port.
  1 = Poor , 5 = Excellent

BroadR-Reach Test Modes



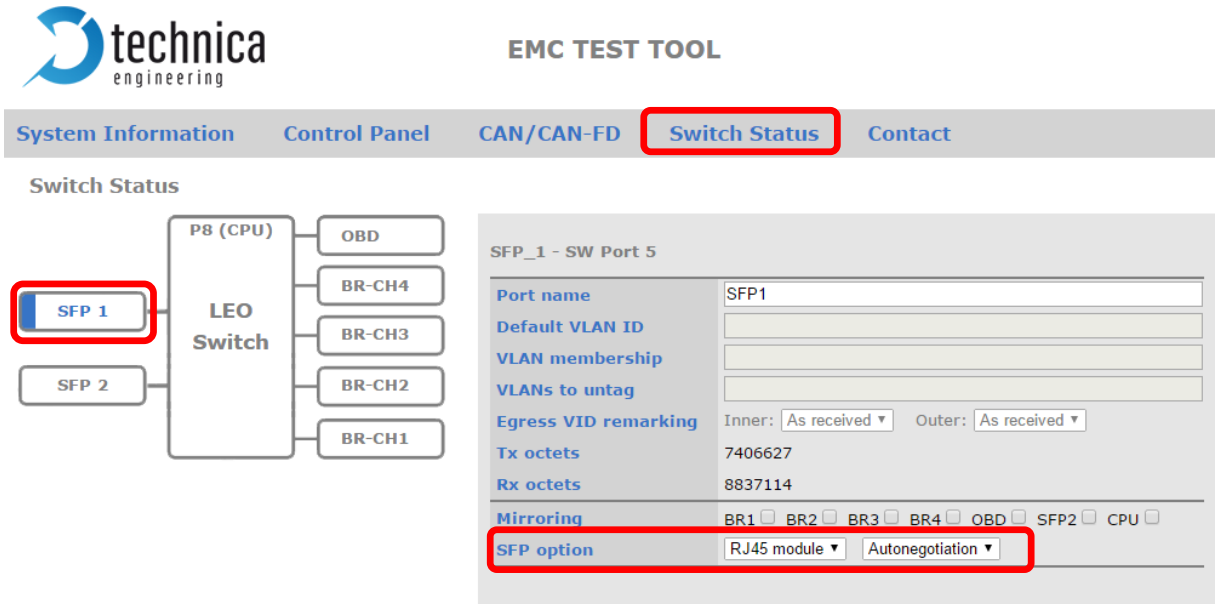
For BroadR-Reach Ports it is possible to set a *BroadR-Reach Physical Layer Test Mode*. There are five test modes defined in the BroadR-Reach Specification to check the compliance of a port.

Warning: When a test mode has been selected, there is no communication possible for this port.

Important: In case to of BroadR-Reach Master, it is mandatory to restart the Switch to recover link.

Note: For compliance testing an oscilloscope with special test software is necessary.

SFP Ports



Besides the common fields to all ports, *SFP* ports allows the user to select which module is connected.

- **Mirroring**: The "Mirroring" feature of a current port copies all **incoming** traffic from the checked port (BroadR-Reach or internal port) to this "capture" port.

Note: Only one port per switch can be the "capture" port! If another port is using the mirroring, Ethernet port cannot use mirroring.

- **SFP option**: The user has the choice of different modules.

  1. The SFP Port can be set to “Fiber” if the user care using a SFP MiniGBIC Fiber module.
  2. Use “RJ45” for copper modules.
  3. The SFP module is not part of standard delivery.

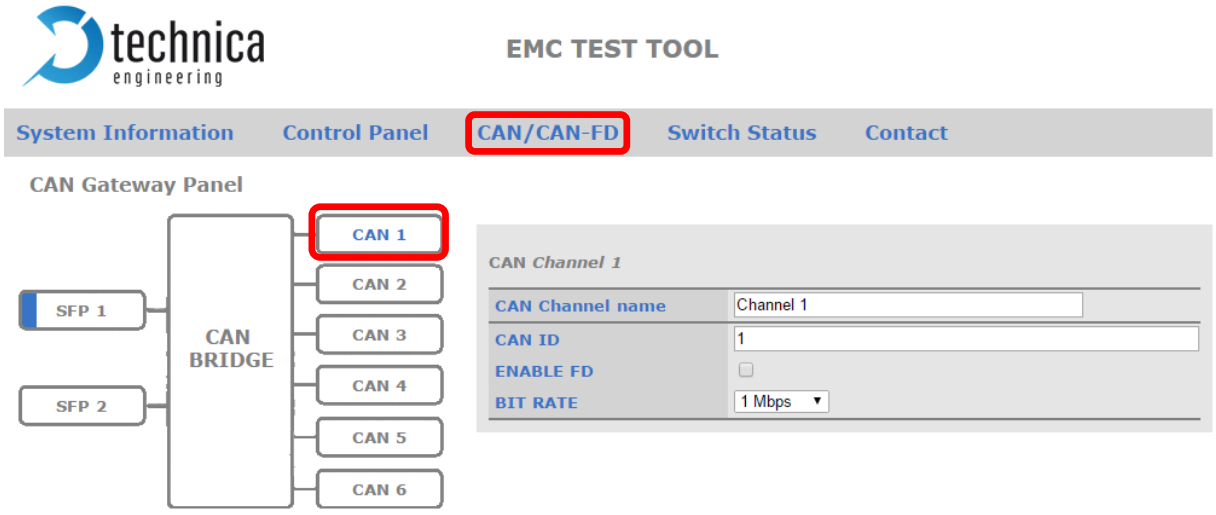
     - ✓ The Edimax Mini GBIC (SFP) LC, 1Gigabit/s, 1000 Base-SX Modules have been tested in this device.
     - ✓ The Bel SFP-1GBT-05 Copper Modules 10/100/1000Base-T have been tested in this device.

Recommended devices:

- ✓ DeLOCK 1x 1000Base-T SFP Modul (86206) copper RJ45 connector
- ✓ DeLOCK 1x 1000Base-SX SFP Modul (86186) optical LC connector

5. Ethernet CAN Gateway

The Ethernet CAN gateway can be configured using a web page. Its properties can be set on the "CAN/CAN-FD" tab. The following picture shows the available settings.



The user can use CAN Parameters table to set CAN Channel speed

- **CAN ID:** Set the CAN ID.
- **Bit rate:** CAN channel speed can be set to: 125 Kbps, 500 Kbps or 1000 Kbps.
- **Enable FD:** Set the CAN module to work as CAN-FD.
- **Bit rate FD:** Set the CAN-FD data speed (appears only if *ENABLE FD* checkbox is checked).

Ethernet CAN Gateway Configuration (Speed and Extreme RAW)

- Speed RAW is faster as normal RAW. Incoming Ethernet-RAW frames are fixed to Ethernet Type: 0x1986

- Extreme RAW is the fastest mode. It is only accepting RAW Frames with EthernetType 0x1987

Structure of a CAN/Ethernet packet

The following picture shows the structure of a CAN packet that is sent as a UDP packet/RAW frame.

B0	B1	B2	B3	B4	B5	B6	B7
	UDP Packet/RAW frame containing CAN Packet						
0	version	CAN Channel	ID	ID	ID	ID	ID type	frame type
8	DLC	D0	D1	D2	D3	D4	D5	D6
16	D7							

Field	Size	Description

version	uint8	Version of the CAN/Ethernet Packet type. It is always 1 for this type of CAN/Ethernet packet.
CAN channel	uint8	Number between 1 and 4 for the channel CAN of this packet.
ID	uint32	CAN ID for base or extended frame format.
ID type	uint8	0 for 11 Bit standard ID 1 for 29 Bit extended ID
frame type	uint8	0 for CAN data frame 1 for CAN remote transmission request
DLC	uint8	Payload length of the CAN packet.
D0 … D7	1 to 8 × uint8	Payload

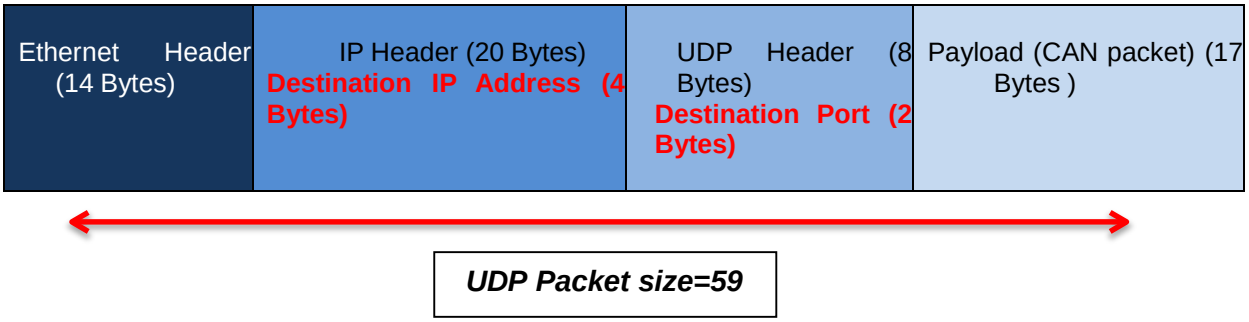
Structure of a timestamp packet

Timestamp packets that are sent on Ethernet use nearly the same structure as CAN/Ethernet packets. The frame type is always 0 and the payload length is always 8. The CAN ID can be set in the web interface**Fehler! Verweisquelle konnte nicht gefunden werden.**. The payload T0…T8 contains the actual timestamp with 1µs accuracy. It is transmitted in big endian format. A payload of 00 00 00 00 00 00 00 01 means a timestamp containing the time 1µs.

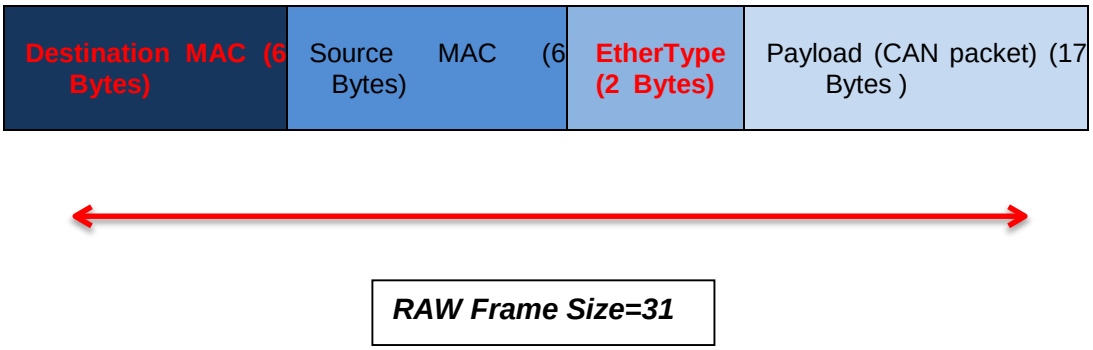
	B0	B1	B2	B3	B4	B5	B6	B7
	UDP Packet /RAW frame containing Time Stamp Information							
0	1	CAN Channel	ID	ID	ID	ID	ID type	0
8	8	T0	T1	T2	T3	T4	T5	T6
16	T7							

Structure of a UDP packet / RAW frame:

- CAN packet packed in a UDP packet :



- CAN packet packed in RAW frame:



Note: Fields in red color are settable through the website (Ethernet CAN Gateway Configuration).

6. LIN Gateway

This chapter describes the two LIN channels (1xSlave and 1x Master) featured by the Universal EMC device.

LIN Basics

LIN (Local Interconnect Network) is a concept for low cost automotive networks, which complements the existing portfolio of automotive multiplex networks. LIN will be the enabling factor for the implementation of a hierarchical vehicle network to gain further quality enhancement and cost reduction of vehicles. The standardization will reduce the manifold of existing low-end multiplex solutions and will cut the cost of development, production, service, and logistics in vehicle electronics.

Features and possibilities

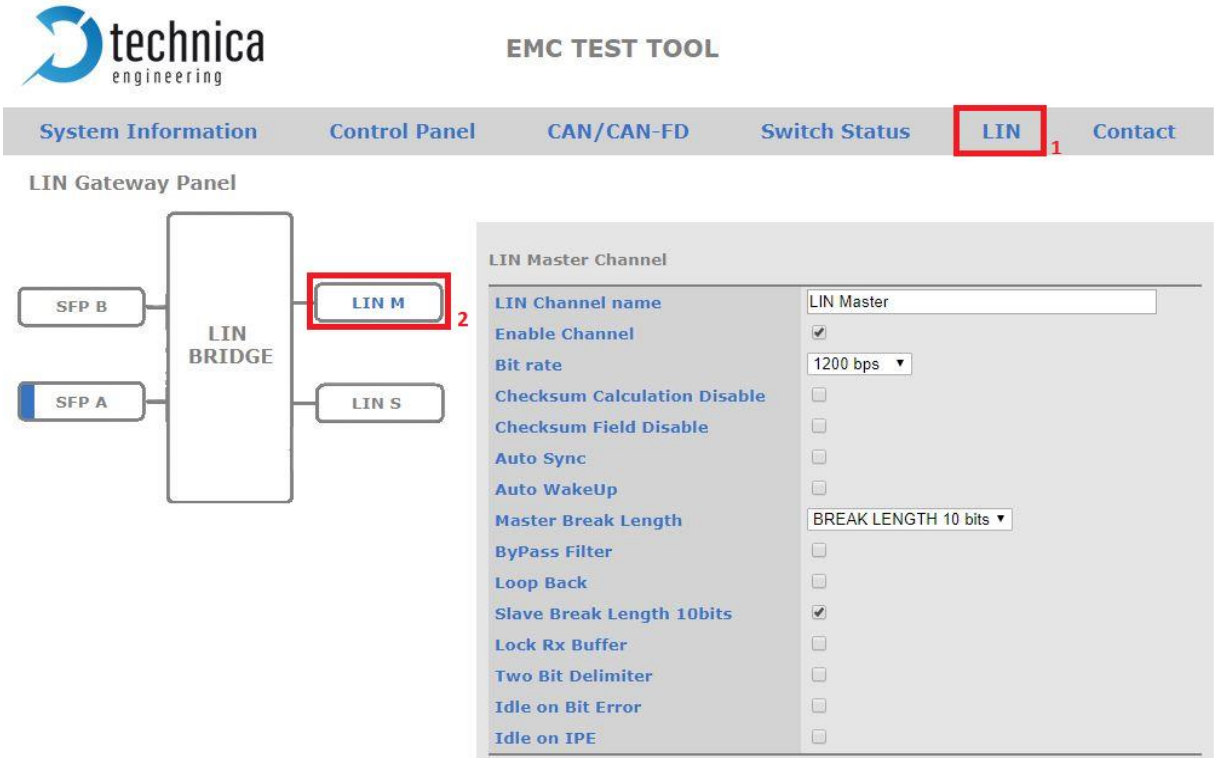
The LIN is a serial communications protocol which efficiently supports the control of mechatronics nodes in distributed automotive applications.

The main properties of the LIN bus are:

- single master with multiple slaves concept
- low cost silicon implementation based on common UART/SCI interface hardware, an equivalent in software or as pure state machine.
- self synchronization without a quartz or ceramics resonator in the slave nodes
- deterministic signal transmission with signal propagation time computable in advance
- low cost single-wire implementation
- speed up to 20 kbit/s.
- signal based application interaction
- predictable behavior
- reconfigurability
- transport layer and diagnostic support

Configuration

To access the LIN channels configuration, one must follow the steps as depicted:



After following the steps above the LIN channel configuration page shall be displayed. Here, the user can set the desired configuration parameters for each module.

Working with LIN

Note: For a proper use of LIN Modules, please note that the **LIN Master** channel can **Send** or **Request** data to/from a specific ID and the **LIN Slave** can **Reply** or **Receive** data from a Master Channel if configured properly.

To send commands to the LIN modules the following Ethernet frame shall be used:

Message	Field	Size	Description
Raw ETH Header	Destination MAC	6 Bytes	Universal EMC MAC
	Source MAC	6 Bytes	Any
	EtherType	2 Bytes	0x1984
Payload	LIN Protocol Version	1 Byte	Set to 2
	Target LIN	1 Byte	1 - Master or 2 - SLAVE
	Status	1 Byte	See full description below
	Tx/Rx	1 Byte	0 is Tx, and 1 is Rx
	LIN ID	1 Byte	Valid IDs set: from 0 to 59
	Data Length	1 Byte	1 to 8 Bytes
	LIN payload	1-8 Bytes	Data to be sent

LIN Status	Value	Description
LIN_SUCCESS	0	The driver call was successful
LIN_NOANSWER	1	If a LIN master request gets no slave response
LIN_ADD_RESPONSE	2	Sets up a LIN slave response
LIN_SEND_WAKEUP	4	Transmits a wake-up signal
LIN_WAKEUP_SENT	5	Wake up signal has been sent
LIN_WAKEUP_RECEIVED	8	A wake-up signal has been received
LIN_SLEEP_REQ_RECEIVED	9	A go to sleep command has been received
LIN_SEND_DATA	0x0A	Send data to a specific ID
LIN_DATA_SENT	0x0B	Data to a specific ID is sent successfully
LIN_REQUEST_DATA	0x0C	Request Data from a specifically ID
LIN_DATA_RECEIVED	0x0D	Data from a specific ID is sent back
LIN_ERROR	0xFF	An unspecified error occurred

Example 1 – Send data using Master Channel

Message	Field	Size	Value
Raw ETH Header	Destination MAC	6 Bytes	0x0050C2E43000
	Source MAC	6 Bytes	0xFFFFFFFFFFFF
	EtherType	2 Bytes	0x1984
Payload	LIN Protocol Version	1 Byte	0x02
	Target LIN	1 Byte	0x01
	Status	1 Byte	0x0A
	Tx/Rx	1 Byte	0x00
	LIN ID	1 Byte	0x38
	Data Length	1 Byte	0x08
	LIN payload	8 Bytes	0xFFAAFF040302010F

Combined frame :

0x0050C2E43000FFFFFFFFFFFF198402010A003808FFAAFF040302010F

By sending this frame to the Universal EMC device the LIN Master Channel will send a frame to the ID **0x38** and the data **0xFFAAFF040302010F (random data).** The protocol parameters will be the ones set by using the website.

Example 2 – Adding a response for the Slave Channel

Message	Field	Size	Value
Raw ETH Header	Destination MAC	6 Bytes	0x0050C2E43000
	Source MAC	6 Bytes	0xFFFFFFFFFFFF
	EtherType	2 Bytes	0x1984
Payload	LIN Protocol Version	1 Byte	0x02
	Target LIN	1 Byte	0x02
	Status	1 Byte	0x02
	Tx/Rx	1 Byte	0x00
	LIN ID	1 Byte	0x38
	Data Length	1 Byte	0x08
	LIN payload	8 Bytes	0xFFAAFF040302010F

Combined frame :

0x0050C2E43000FFFFFFFFFFFF1984020202003808FFAAFF040302010F

By sending this frame to the Universal EMC device the LIN Slave Channel will set a response with data **0xFFAAFF040302010F (random data)** when a data request with the **ID 0x38** will be received.

Note: The maximum number of responses which can be added is 16.

Note: The ID for each answer shall be unique.

Note: When the maximum number of responses is bigger than 16, the responses will be overwritten starting with first one (circular buffer).

Note: To each received command for the LIN modules, the Universal EMC device shall reply to the PC with a status (Ex: Command Status = LIN_SEND_DATA results Reply Status = LIN_DATA_SENT) and with the received data.

7. VLAN Configuration

This chapter describes the Virtual Local Area Network (VLAN) feature supported by internal switches present in the device. Universal EMC device provides flexible VLAN configuration for each ingress (receiving) port.

Note: It is not possible to cover all possible combinations that VLAN feature provides. It will be explained as accurate as possible with a couple of uses cases.

VLAN Basics

A Virtual LAN (VLAN) is a **logical** switched LAN formed by segmenting physical Local Area Networks (LANs).

Separating a switched LAN into one or more VLANS provides multiple advantages:

1. Multicast and Broadcast packages flood are limited only to the required segments to save LAN bandwidth.
2. Provides security. LAN traffic is restricted only to its specific segment.

3. Eases management by logically grouping ports across multiples switches.

VLAN work in the same was as physical LANs. Source device sends a packet to an end station or network device inside the same VLAN.

The Universal EMC device allows the user to create Virtual Local Area Networks (VLANs), in order to sepa- rate traffic of different sources and providing a better general performance.

Port-Based VLAN

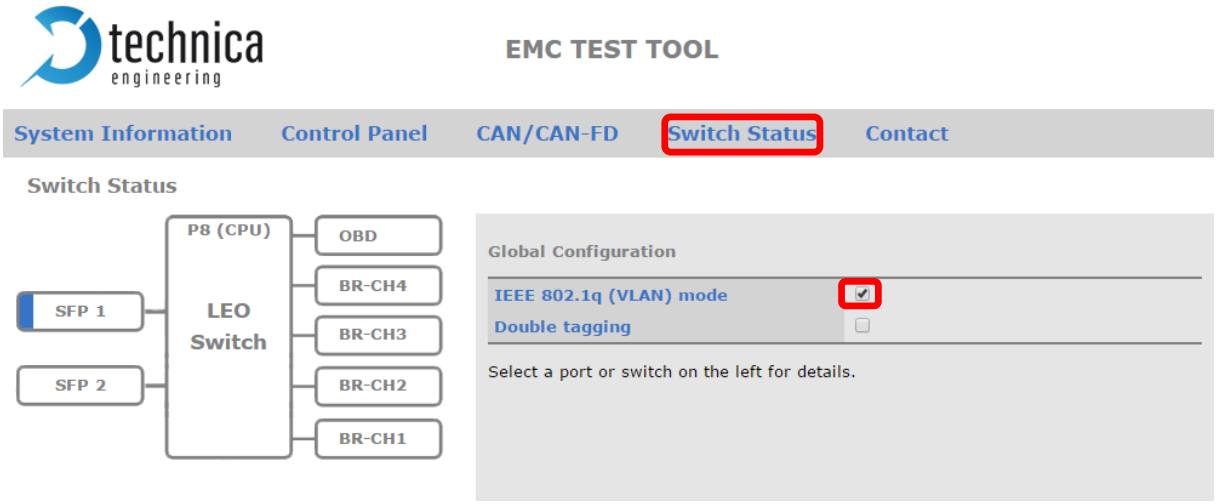
Universal EMC device uses port-based VLAN. This feature partitions the switching ports into some virtual private domains designated on a per-port basis. Data switching outside of the port private domain is not al- lowed.

The port-based VLAN feature works as a filter, rejecting all the traffic destined to non-private domain ports.

Once a packet is received, the switch of the Universal EMC device tries to identify the VLAN for the received packet. A port based VLAN determines the membership of a data frame by examining the configuration of the port that received the transmission or reading a portion of the data frame's tag header. A four-byte field in the header is used to identify the VLAN. This VLAN identification indicates what VLAN the frame belongs to. If the frame has no tag header, the switch checks the VLAN setting of the port that received the frame. If the switch has been configured for port based VLAN support, it assigns the port's VLAN identification to the new frame.

Single Tagging - IEEE 802.1q (VLAN) mode

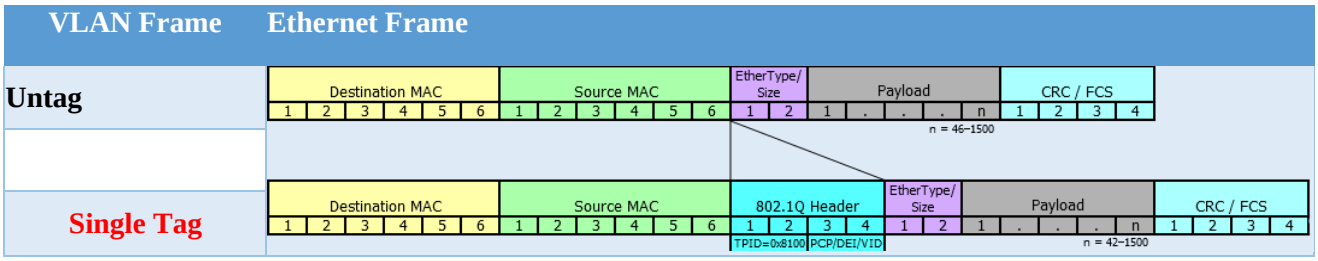
When the “IEEE 802.1q (VLAN) mode” is enabled, it is possible to can up to 4096 VLANs (Virtual Local Area Network) for routing the traffic through the switch.



Note: This is a global option applying to all three switches.

Warning: Expert knowledge is needed to use these VLAN settings! Only use these settings if the user has understood the VLAN process.

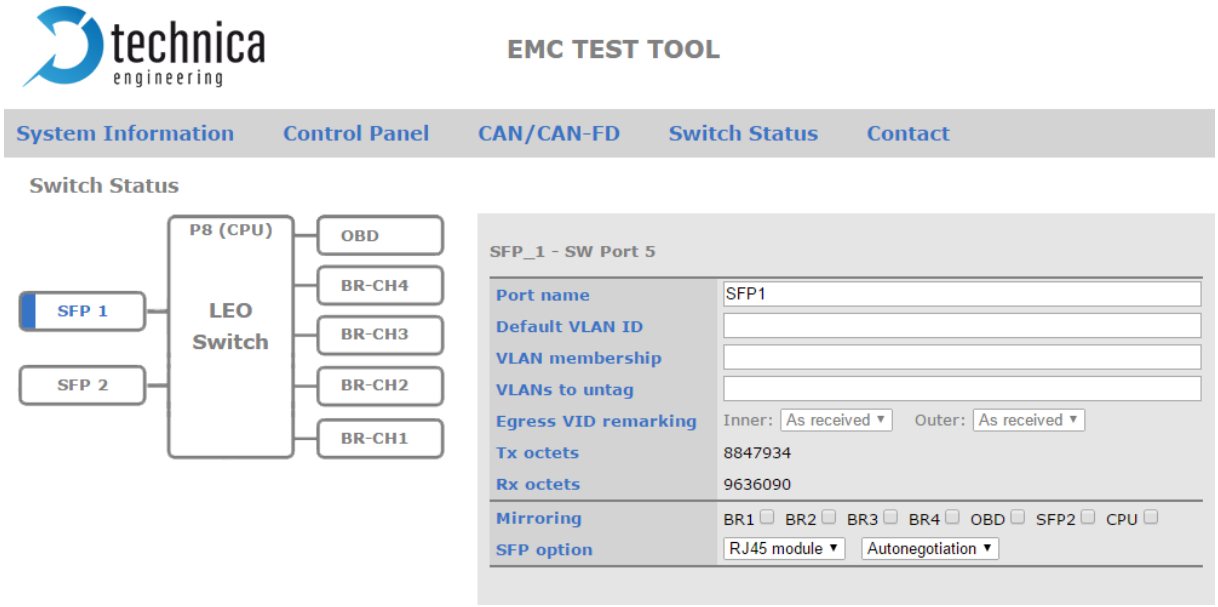
Difference between a normal Ethernet and a Single tagged VLAN frame is represented as it follows:



TPID = Tag Protocol Identifier, EtherType.
A value of 0x8100 indicates that the frame has VLAN 802.1q information.

VID = Vlan Identifier.
A value indicating to which VLAN domain belongs the packet.

View of the Port Configuration with Single Tagging activated:



Once *IEEE 802.1q (VLAN) mode* is enabled, several fields common to all ports will be avaliable:

- **Default VLAN ID**: User can set the default VLAN identifier for this port.

  Note: Untagged frames received to this port will be tagged with its Default VLAN ID. If user does not set a Default VLAN ID, frames will be tagged with ID=1 at ingress.

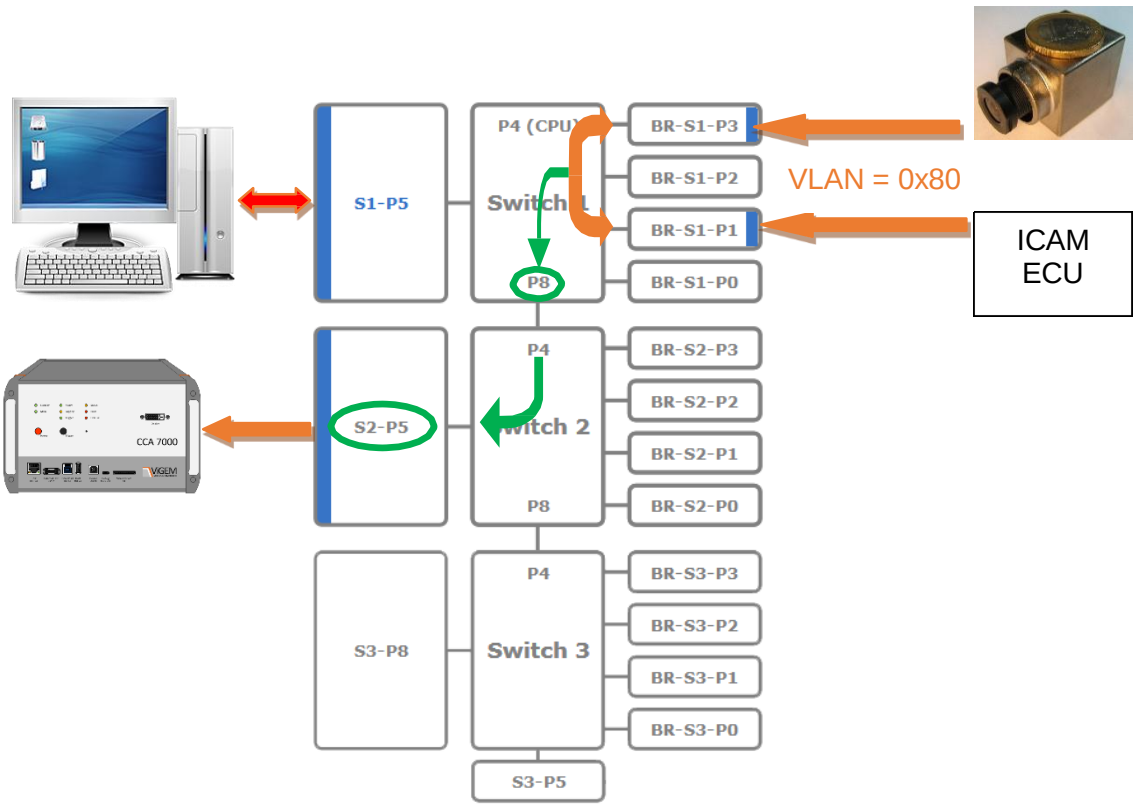
- **VLAN Membership**: Setting a "VLAN membership" ID makes the port a member in the given virtual LAN. The switch will route ("forward") packets which are tagged with one of these IDs to this port.

- **VLAN to untag**: Packets matching this list of VLAN IDs will be untagged at egress ("outgoing").

Single Tagging Example (referenced from the Media Gateway user manual)

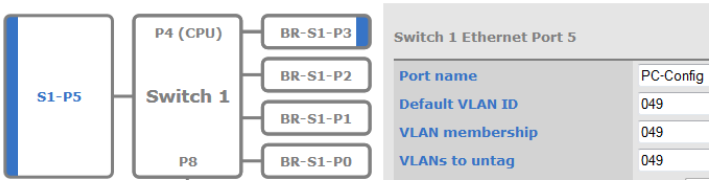
If user needs to analyze traffic between a Camera and ICAM to a "stand alone" datalogger or a computer using a Traffic analyzer, following setup can meet this purpose.
User wants to:

1. Set VLAN for accessing to the webpage of Universal EMC device.
2. Set VLAN between ports *BR-S1-P3* and *BR-S1-P1* and redirect it to Log Device at S2-P5.



Setting VLAN from Universal EMC´s webpage.

a. For PC-Config port (S1-P5) we set a both VLAN and a VLAN Membership to 0x49



Warning: As our computer is not using VLAN, we untag packets.

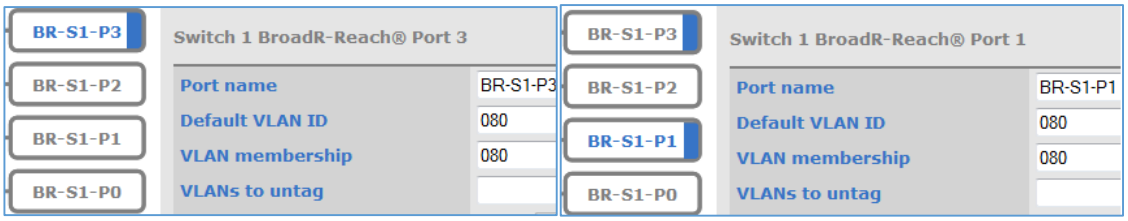
b. For CPU port, we set the same VLAN as in PC-Config.

Warning: Universal EMC´s CPU is not using VLANs. Make sure the user untag the frames.

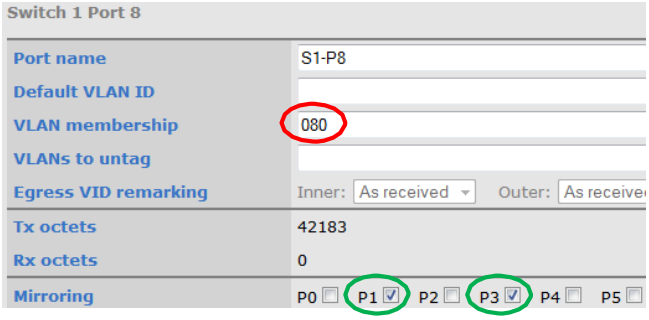
2. Setting VLAN between ports *BR-S1-P3* and *BR-S1-P1* and redirect it to Log Device at S2-P5.

It is supposed that the devices (*Camera and iCAM*) are working with VLAN ID=0x80. Now we are going to create a VLAN with *ID 0x80* between ports *BR-S1-P3* and *BR-S1-P1*.

a. Create a VLAN with ID 0x80. Ports *BroadR-Reach 1* and *3* will be members.

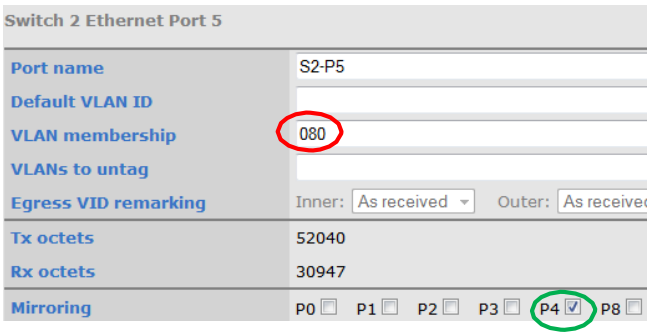


b. Datalogging is on *Switch2 – Port5*. User has to do a Mirroring from Ports *P3* and *P1* to obtain a copy of traffic flow to *P8*.



Note: *Mirroring copies only traffic inside the same VLAN Membership.*

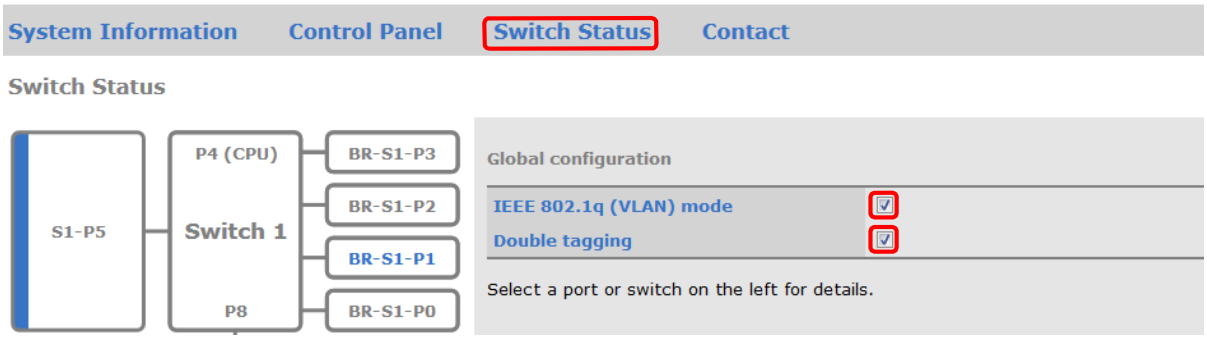
c. On port P4 from Switch-2, the membership 0x80 must be added. At this moment all the packets from ports P3 and P1 from the Switch 1 will be visible through P4. Last step is forwarding all the traffic to the Datalogger port S2-P5.



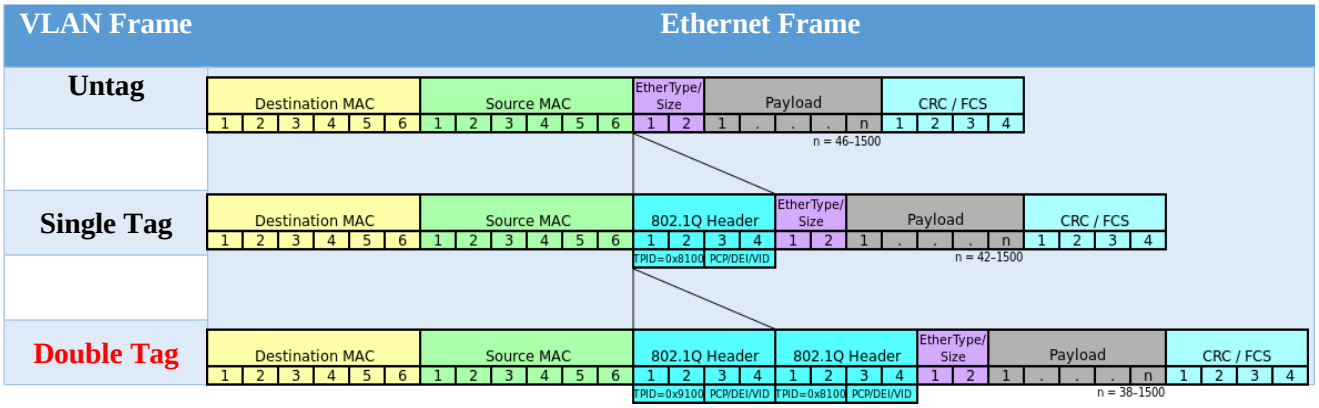
Double Tagging - IEEE 802.1q (VLAN) mode (referenced from Media Gateway user manual)

Universal EMC device supports *Double tagging*. This feature can be enabled at the global configuration.

Note: This is a global option applying to all three switches.



This feature allows to use a second tag "Outer Tag" besides the Single tag "Inner Tag". This extra tag (Double tag) provides an addition layer of tagging to the existing IEEE 802.1Q VLAN. When the double-tagging feature is enabled, users can expect two VLAN tags in a frame.

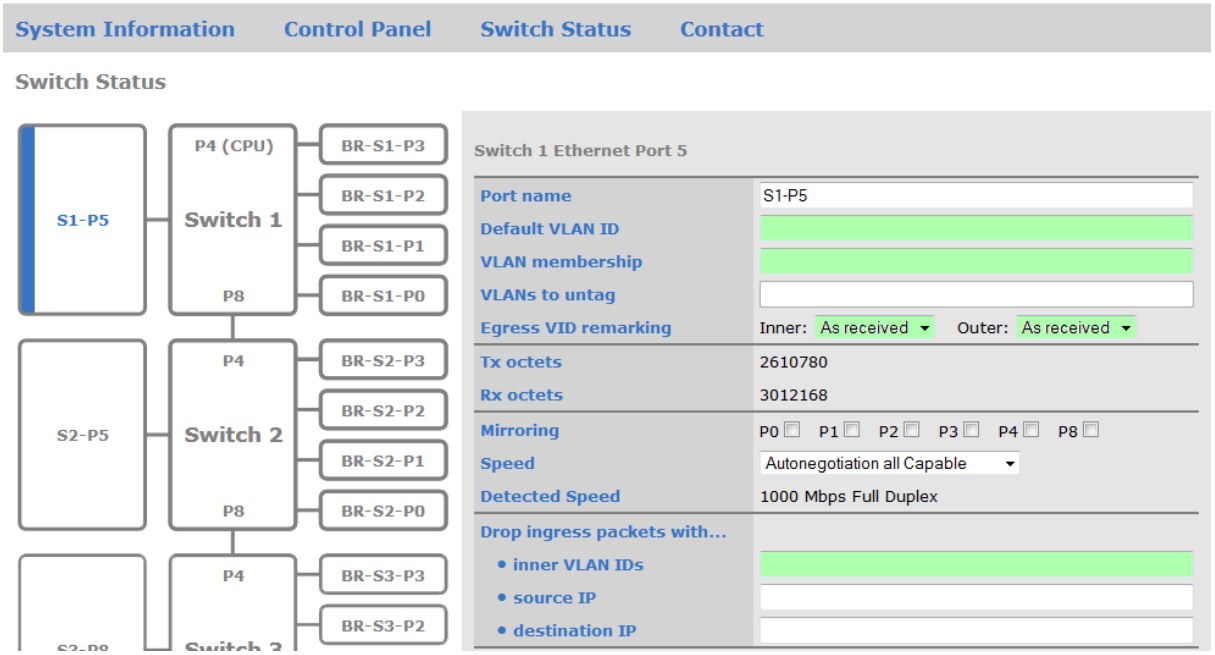


TPID = Tag Protocol Identifier, EtherType.
A value of 0x9100 indicates that the frame has double tag information.

Outer VID = Tag close to Source MAC is the ISP tag (Outer Tag).

Inner VID = Tag following is the Customer tag (Inner Tag).

With enabled “Double tagging” for each port, user can set now the following parameters for VLAN settings. Following picture shows in green the available fields for *Double tagging*.



Default VLAN ID: User can set the default VLAN identifier for this port.

Note: Untagged frames received to this port will be tagged with its Default VLAN ID. In case of

VLAN Membership: Setting a “VLAN membership” ID makes the port a member in the given virtual LAN. The switch will route (“forward”) packets which are tagged with one of these IDs to this port.

VLAN to untag: Packets matching this list of VLAN IDs will be untagged at egress (“outgoing”).

Note: This option is not available if *“Double tagging”* is activated.

Drop ingress packets with inner VLAN IDs: Packets matching this list of VLAN IDs will be dropped.

If double tagging is active the "Normalization" process takes place on all ingress packets on all ports. The normalization process modifies all incoming packets with one or zero VLAN tags so that every packet has two VLAN tags afterwards. Every packet that flows through the switch is double tagged.

Three different cases of normalization are possible:

1. Packet is received with two VLAN tags (double tagged)
   - The packet will be left unchanged
   - The packet will be forwarded if the packet VLAN is matching its Outer VLAN membership.

2. Packet is received with one VLAN tag (a single tagged packet with a so called customer tag /inner tag)
   - A second tag (also called ISP /outer tag) with TPID 0x9100 will be added with configured with the "Default VLAN" ID for this port to the packet during normalization.

3. A packet is received without any VLAN tags
   - In this case, the normalization process adds two VLAN tags, the inner tag with TPID 0x8100 and the outer tag with TPID 0x9100. Both tags will hold the "Default VLAN" ID of this port. With double tagging enabled, only the **outer** tag (the one with TPID 0x9100) is relevant for frame forwarding, i.e. the "VLAN membership" refers to the outer tag.
     TPID = Tag Protocol Identifier, EtherType
     A value of 0x8100 indicates that the frame has VLAN 802.1q information.
     A value of 0x9100 indicates that the frame has QinQ (Double Tagging).

With "Egress VID remarking" (available if double tagging is enabled only) the user can specify, how to modify the packets before they are sent on this port.

Three options are available for inner and outer VLAN tag:

1. **"As received"** means the tag shall left unchanged as the packet was received from its ingress port.
   If this tag was there before normalization it shall be sent with the same value. If no tag was there on ingress it shall be sent without this tag.

2. **"Normalized"** means that the tag shall be sent as the internally normalized VLAN tag.

3. **"Remove"** indicates that this tag shall be removed before the packet is transmitted.

Double Tagging Example (referenced from Media Gateway user manual)

The scenario of this use-case is:

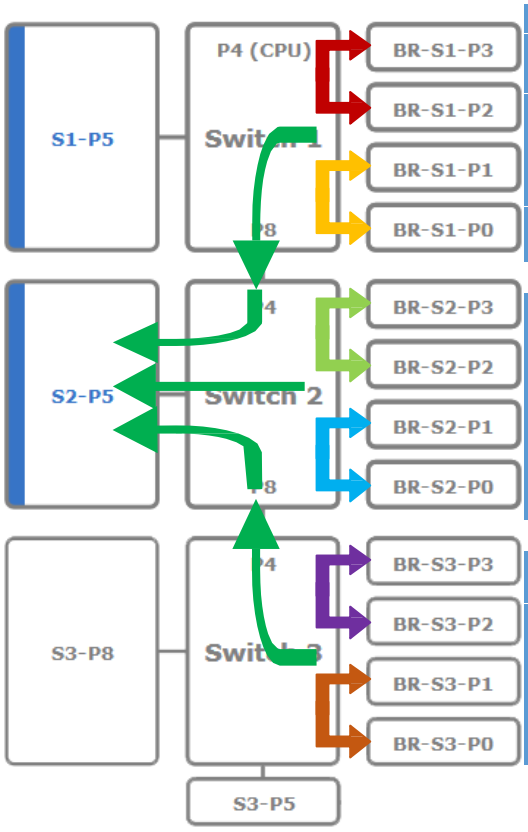
- Up to six BroadR-Reach cameras should be connected to their dedicated ports on one central ICAM ECU.
- Each camera stream must not influence the other camera streams.
- Mirroring of all the camera data streams to the "Datalogger" gigabit Ethernet port has to be possible.

Note: By default all series cameras are configured as a BroadR-Reach *Master* and *FullOut*.

The BroadR-Reach cameras used for series production send their Ethernet packets with a VLAN tag (inner Tag) to identify the "type" of traffic transported in it (e.g. video- or control-data).

With *double tagging* a VLAN "outer-tag" will be added to each data packet.
After all data is stored on the datalogger hard disk drive, the *information "On which connection has the packet been received?"* can be derived from the ID number of the "outer tag".

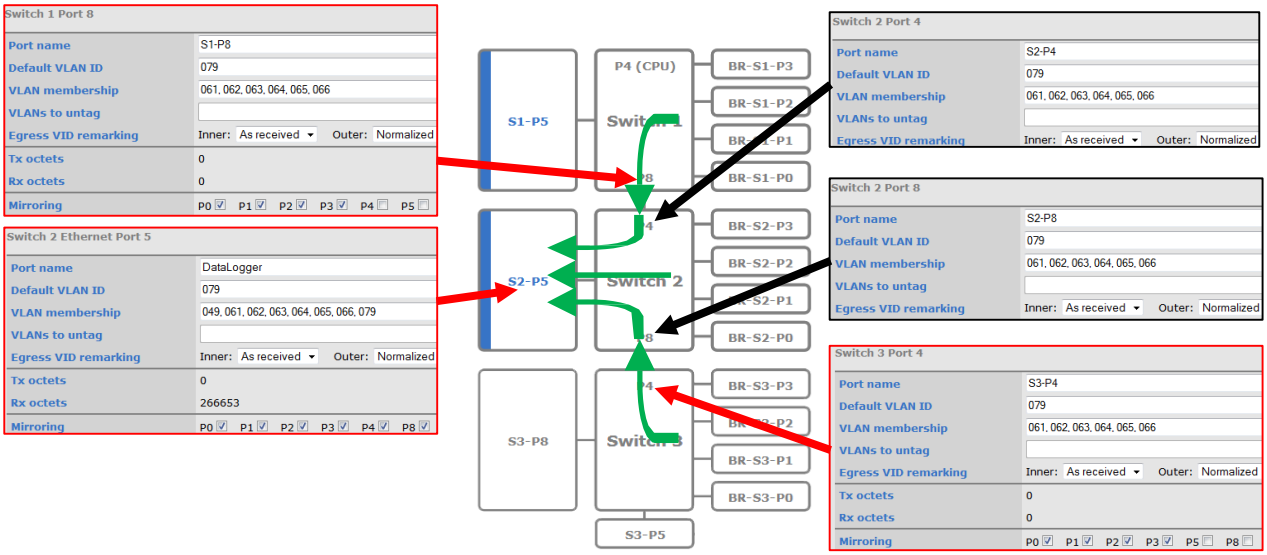
Each Ethernet packet recorded by the data-logger has an inner VLAN tag (with TPID 0x8100) showing the type of traffic and an outer VLAN tag (with TPID 0x9100) containing information about the ingress port.
Packets sent from the camera to the ECU (and vice versa) will show up unchanged on the outgoing BroadR-Reach port with only one VLAN tag. The switch is "transparent" for this connection.



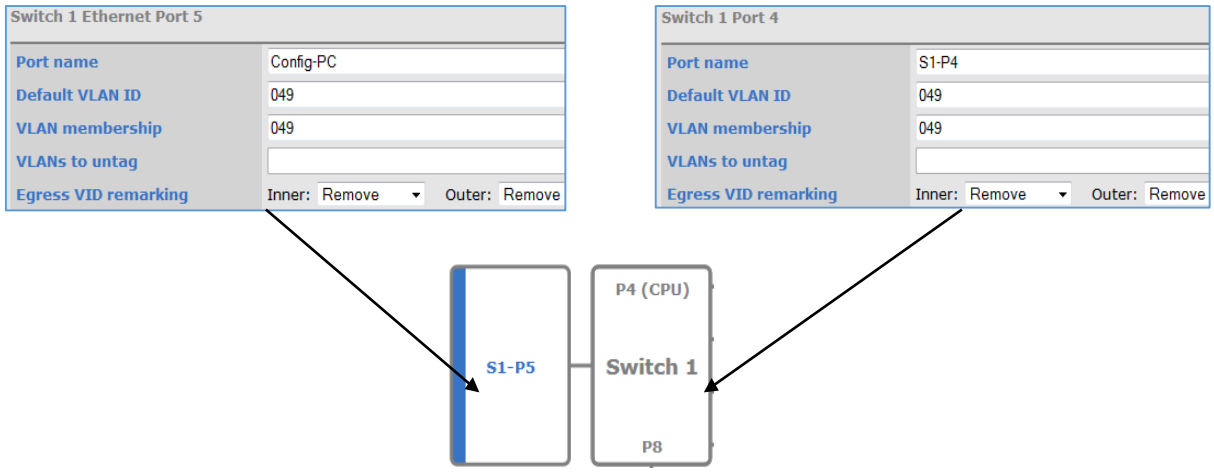
PORT	BroadR-Reach	Connected device	VLAN Outer-Tag
BR-S1-P3	Slave	Camera 1	0x61
BR-S1-P2	Master	ECU Port 1	0x61
BR-S1-P1	Slave	Camera 2	0x62
BR-S1-P0	Master	ECU Port 2	0x62
BR-S2-P3	Slave	Camera 3	0x63
BR-S2-P2	Master	ECU Port 3	0x63
BR-S2-P1	Slave	Camera 4	0x64
BR-S2-P0	Master	ECU Port 4	0x64
BR-S3-P3	Slave	Camera 5	0x65
BR-S3-P2	Master	ECU Port 5	0x65
BR-S3-P1	Slave	Camera 6	0x66
BR-S3-P0	Master	ECU Port 6	0x66

Note: For BR-Ports, **Egress VID Remarking** will be set. **Inner**: *As received*. **Outer**: *Remove*

The “Datalogger” gigabit Ethernet port and the internal ports (P4, P8) connecting the three switches are configured so that all incoming BroadR-Reach packets will be mirrored to the data-logging port, regard- less of the address resolution learning mechanism of the switches (“promiscuous mode”). To achieve this, suitable mirror maps are defined as well as the VLAN Memberships of the BR-Ports for the internal ports (S1-P8 and S3-P4) and the data-logging port (S2-P5).



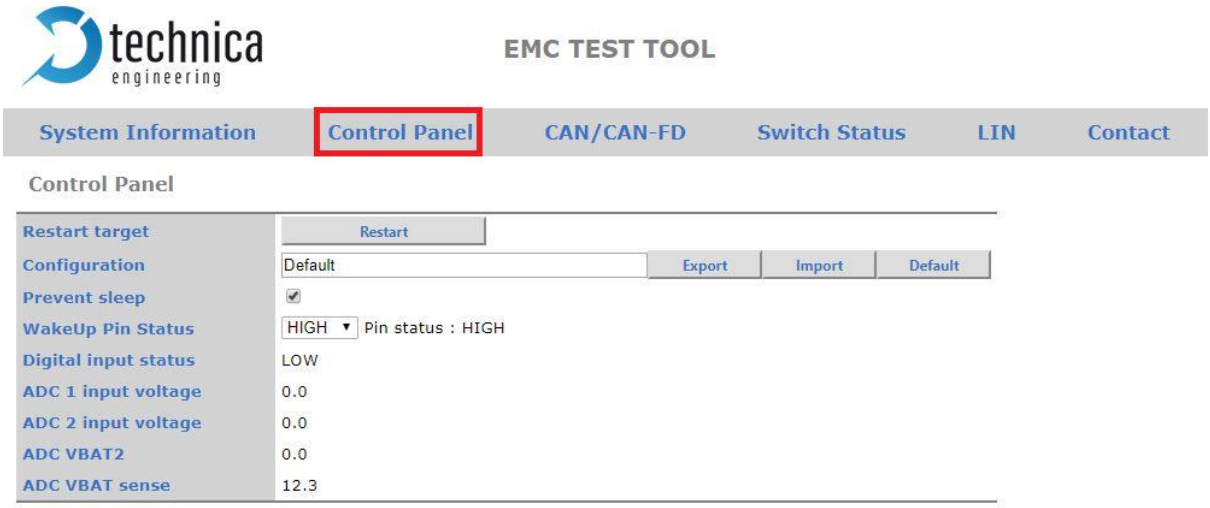
The gigabit Ethernet port “Config-PC” shares a private VLAN (ID 0x049) with port S1-P4 to be able to reach the internal CPU of the MediaSwitch for configuration and status-monitoring. All outgoing pack- ets on the “Config-PC” port will be untagged (all VLAN tags removed) for usage with a standard desk- top PC.



Note: There is a pre-configured port-based forward map that avoids packet-forwarding from ports other than the “Config-PC” port to the CPU port (S1-P4). This rule is intended to prevent flooding the CPU with useless packets and prevent loops. This implies that the integrated webserver of the MediaSwitch is reachable via the port “Config-PC” only.

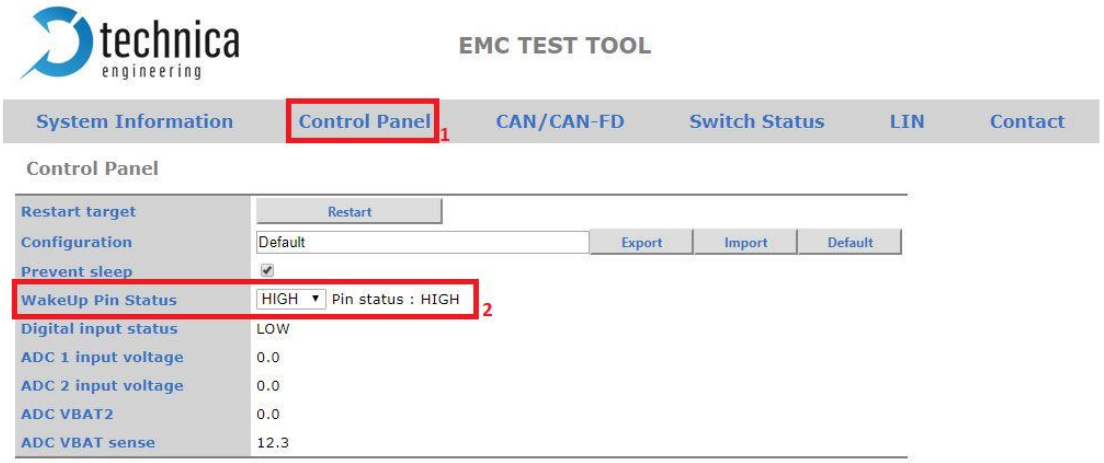
8. Additional Features

For an extended application range Universal EMC features a Digital Output (Wake-Up pin), 2xADC channels, ADC Power Supply voltage feedback.
For controlling and feedback, one shall select the **Control Panel** Tab in the website:



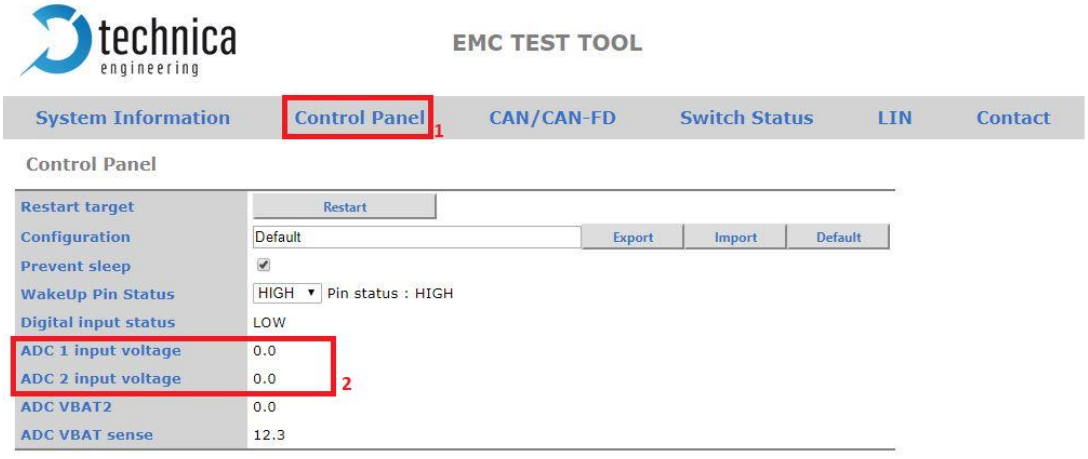
Wake-up Control

The Wake-Up pin can be controlled using the website as depicted:



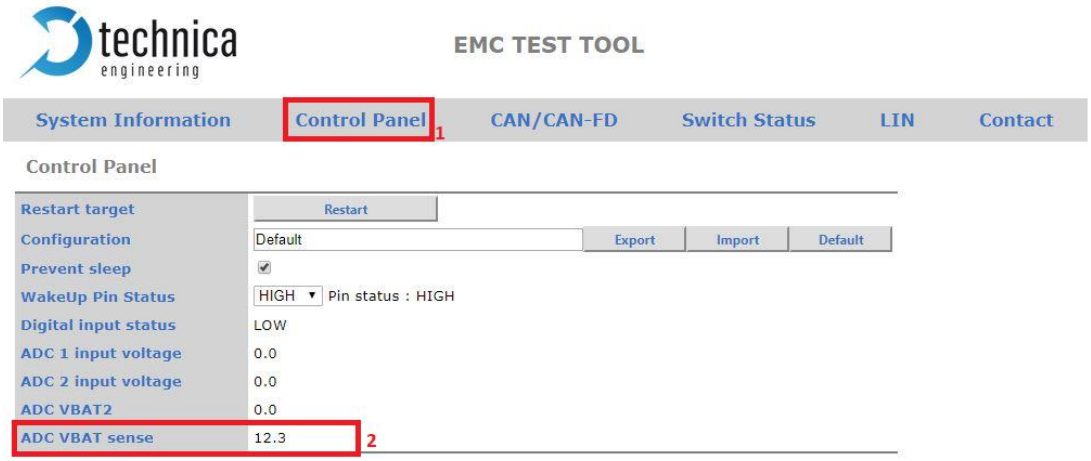
ADC input feedback

The two ADC channels feedback can be found as depicted:



Power Supply Input Feedback

In the same tab, the voltage supplied to the board can be found:



Note: All the status details are updating dynamically. That means that you do not need to refresh the page to get the feedback at a certain time.

9. Application Firmware Update

For the newest SW version of the Universal EMC device please contact **Technica Engineering**.

The application firmware of the device may be updated by the following process:

Warning: Never downgrade the bootloader or application to a former version. This could cause serious problems.

Note: If the user updates the application the bootloader should also be updated to the latest version.

Warning: Not following this instruction may cause erroneous states of the device. The user must send it back to Technica Engineering for repair. Technica Engineering may charge support fees for this service.

Warning: Only upgrade to the latest firmware. Do not downgrade to old releases. Otherwise it may happen that the user cannot access the device anymore because old firmware does not support new hardware.

Note: The user need to have administration privileges on a Windows PC to be able to do the firmware update on the Universal EMC device.

1. Power up the device by a stable 12 Volt DC power supply. Do **not** switch off the power supply during the update process.
2. It is recommended to connect the Wake-up line (Pin 8 of the black MQS connector) to 12 Volt of the same power supply to make sure the ECU is awake during update.
3. Connect a Windows PC with a RJ45 cable directly to an SFP Port of the Universal EMC device and make sure there is a link.

4. Disconnect all other Ethernet, CAN, FlexRay, LIN and BroadR-Reach links from the device.

5. **Disable the Firewall** of the Windows PC. Set the network device of the PC to the same subnet as the Universal EMC device. (For example, 192.168.0.100 and 255.255.0.0)

6. Check that the user firmware package the user received from Technica Engineering contains the following files:
   redtool.exe Emc_Leo.crc.srec

   The user will need to have java installed on the user PC.

7. Check that the "Host" LED toggles slowly (so the device is running in application mode).

8. Check that the user can access the website at 192.168.0.49 (or whatever the IP address of the Universal EMC device is).

9. Open a DOS-Box and execute the following command to enter bootloader mode:

   redtool.exe -t 192.168.0.49 -e

   Option –t specifies the IP Address of the Universal EMC device.
   Option –e restarts the Universal EMC device and starts it in bootloader mode.

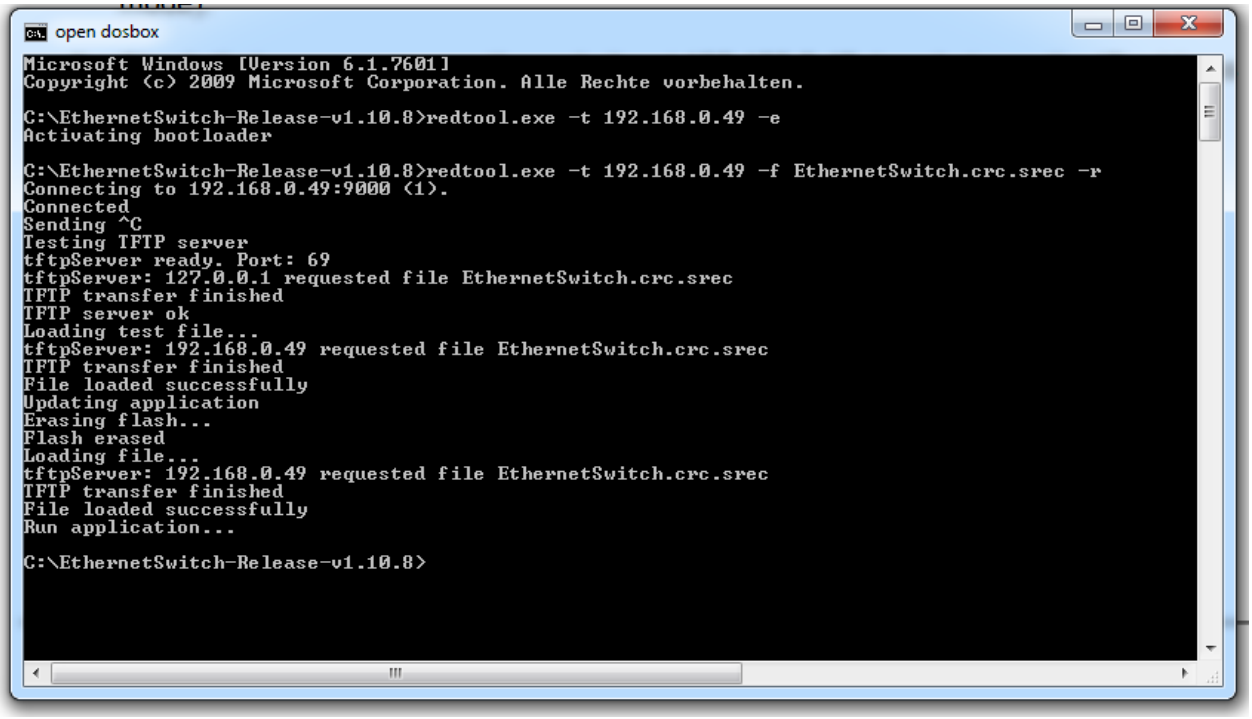
Note: The Host LED is blinking fast when in bootloader mode.

10. In the DOS-Box execute the following command:

    redtool.exe -t 192.168.0.49 -f Emc_Leo.crc.srec -r

    Option –t specifies the IP Address of the Universal EMC device. Option –f specifies the new firmware file.
    Option –r activates the application mode after successful update.

Note: during the update process the Host LED will stop to blink. This is a normal condition. Do not reset the device! The update process will **last about one minute**. When the update is finished the Host LED will toggle slowly again.



11. The user can re-activate the user Windows firewall after successful update.

10. Frequently Asked Questions – FAQ

Q: What is the delay time for Ethernet packets through the switch?
A: The propagation delay of the switch depends on the load. The switch works collision free. So buffers are used to solve collisions. These buffers delay packets for some time and cause delay jitter. On high load these times rise exponential.
On normal load the delay should be about 0.3 ms. But if the packed passes all 3 switches it may sum up to about 1 ms.

Q: Is AVB supported?
A: Currently Audio Video Bridging is not supported.
It is planned to implement automotive time synchronization .1AS features as soon as they have been fully specified.

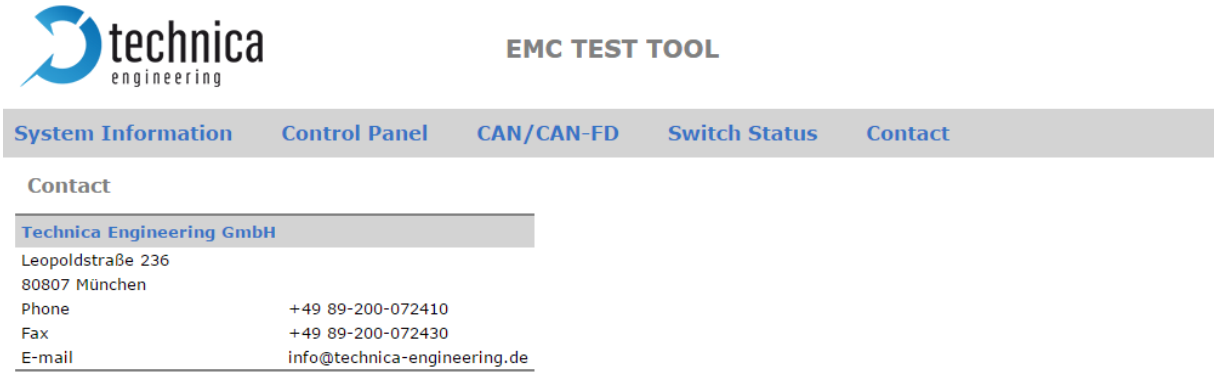
Q: When I use the Universal EMC device in my test setup, I cannot access the configuration website anymore.
A: The host microcontroller is jammed by mislead packets. Please use a valid VLAN configuration and avoid too much broadcast packets.

Q: After a firmware update the host LED is still blinking fast. What to do?
A: The firmware update failed and the host is still in bootloader mode. Please restart the device and try to update the application again as described in this manual.

Q: All LEDs on the front of the Universal EMC device are lit permanently?
A: The host microcontroller is not running. Maybe a firmware update has failed. Please send the device to Technica Engineering GmbH for service.

Q: I have problems with firmware update. TFTP Timeout error is appearing.
A: It is known that some Ethernet-USB adapters are having problems with Update procedure. Try to connect the user Universal EMC device directly to the user integrated LAN Adapter.

11. Contact



In the „Contact Tab“ information is displayed how to contact us if the user need service.

For any type of questions regarding this product please contact us at:

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80807 München Germany

info@technica-engineering.de

www.technica-engineering.de