Flashlink®

USER MANUAL

FR-2RU-10-2-F/-C

flashlink® and ConQuer® 2U frame

Network Electronics ASA
Thorøya
3204 Sandefjord, Norway
Phone: +47 33 48 99 99
Fax: +47 33 48 99 98
e-mail: support@network-electronics.com
www.network-electronics.com
Direct Service Phone: +47 90 60 99 99

Revision history

The latest version is always available in pdf-format on our web site:

http://www.network-electronics.com/

Current revision of this document is the uppermost in the table below.

Rev.	Replaces	Date	Change Description
5	4	07.05.03 RS	Included the control protocol
4	3	25.03.03 RS	Corrected printing errors in Chapter 2.1, added GPI information and product designations, shortened fiber optics chapter.
3	2	12.04.02 NBS	Corrected Figure 6 (Chapter 3.4).
2	1	10.07.01 NBS	Changed AURORA to GYDA
1	0	21.12.00 RS	New laser classification, new silk screen on connector module (fig. 2), corrected address setting of sub-rack module (swapped 0 and 1 in fig. 6)
0	A	15.12.00 NBS	Renamed Optronics to Electronics & Rev. Control
A	-	23.06.00 RS	Initial Revision

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1. General

The FR-2RU-10-2, hereafter called "sub-rack", is a compact sub-rack frame, providing space for up to 10 flashlink and/or ConQuer modules of any combination, in addition to two fixed positions for power supply modules. The sub-rack is available in two versions, one for flashlink denoted FR-2RU-10-2-F with a flashlink logo in front, and one for ConQuer denoted FR-2RU-10-2-C with a ConQuer logo in front.
The sub-rack features maximum flexibility as every module comes with a suitable back-plane module, which takes up n x 7TE spacing. This means that any combination of all modules can be fitted into the sub-rack, or expanded / rebuilt in the future, when other functionality is needed. Each sub-rack has an address setting available through DIP-switches on the rear, for use in combination with the GYDA-SC-M Rack System Controller card.

1.1 Specifications

AC power:	AC power supply module 100-260 VAC (PWR-AC15/15/5/5V)
DC power (optional):	DC power supply module 36-72 VDC (PWR-DC15/15/5V)
Redundant power (optional)	
Dimensions:	483 x 88 x 178 mm (19”, 2RU)
Card slots	10
Power supply slots (reserved)	2
Internal voltages:	+5V, + 15 V, -15 V

1.2 Connection drawing

Figure 1 is an example of a fully equipped flashlink sub-rack, seen from the rear side.
To the left is the connector module for the power supply delivered with the sub-rack. The other connector modules are described in their respective user manuals.

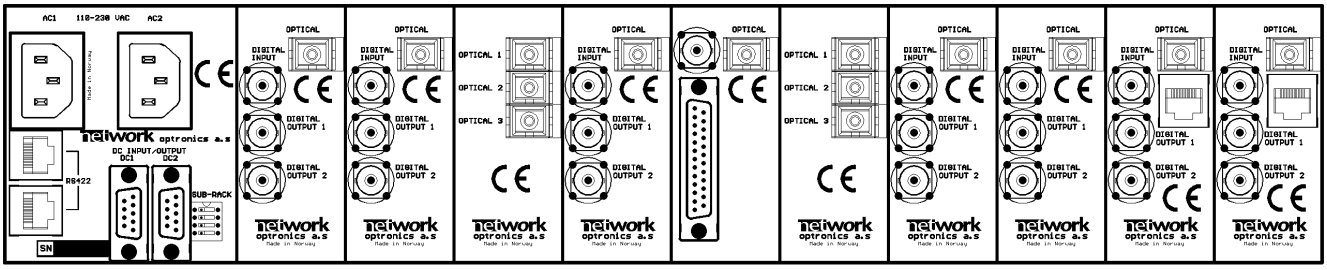


Figure 1. Example of fully equipped flashlink sub-rack.

1.3 Module card LED's

The uppermost LED of each module card is a "general status" LED.

- Green light means that the card is OK.
- Red light means that the card is faulty.

- No light means that the power is not switched on.

The meaning of each LED on the module cards is described in their respective manuals.

2. Power connection

Figure 2 shows the power connections of the sub-rack as well as the RS-422 connections and the DIP-switches for address setting of the sub-rack.

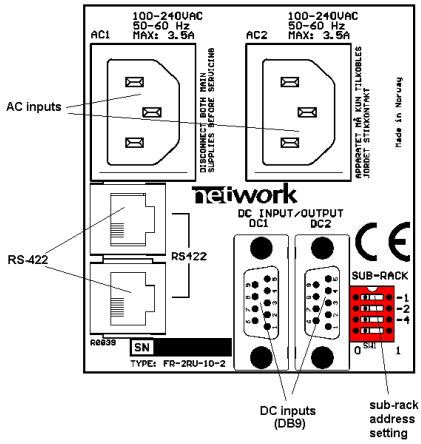


Figure 2. Connector module for the power supply.

AC: Connect mains to the sub-rack with a mains cord with an IEC 320 connector.
DC: Connect the DB9 male connector from the external DC power supply to the main unit. Tighten the screws to ensure a proper contact. The DC inputs have the same function; the left input (DC1) is for the left power module when seen from the rear and DC2 is for the right power module when seen from the rear.

2.1 Pin-out DB9:

The maximum current drawn from each pin of the DB9 connector is 2,5A.
The power supply is able to deliver an overall maximum current of 6A at 5V and 1A at +/-15V.

The pin-out is the same for both DC1 and DC2.

Pin 1	GND for DC	
Pin 2	+5V	Output
Pin 3	Relay	Open in normal state
Pin 4	+15V	Output
Pin 5	Positive part of 48V DC supply	Input
Pin 6	Reserved	
Pin 7	Relay	Open in normal state
Pin 8	-15V	Output
Pin 9	Negative part of 48V DC supply	Input

Pin 1, 2, 3 and 8 are common to both DC1 and DC2. (Physically connected).

When the power supply is in operation, a green LED will light on the front.

Figure 3 The front of FR-2RU-10-2-F, showing the power LEDs.

If a redundant power supply solution is used, both power-LEDs will show green light.

2.2 GPI Power Supply Status Outputs

The GPI module status outputs can be used for wiring up alarms for third party control systems.
In case of power failure, pins 3 and 7 will be physically connected (low impedance), otherwise the connection between pins 3 and 7 will be high impedance.

3. RS-422 connection

At the rear end of the sub-rack is an RS-422 bus. When used in combination with the GYDA-SC Rack System Controller, up to 8 sub-racks can be controlled. On the rear end of the sub-rack are DIP-switches where each sub-rack can be assigned its own address (see figure 2).
The RS-422 interfaces are shown in figure 2.

3.1 Pin-out RS-422

Pin 1	Rx A (+)
Pin 2	Rx B (-)
Pin 3	Tx A (+)
Pin 4	Reserved
Pin 5	Reserved
Pin 6	Tx B (-)
Pin 7	nc
Pin 8	nc

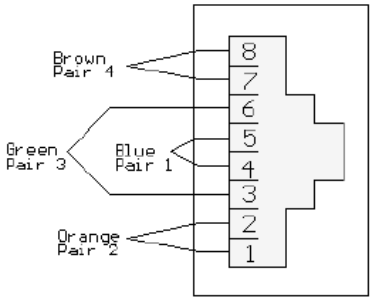


Fig. 4 RS-422 inlet

3.2 RS-422 protocol

Hardware interface
The hardware interface is basically RS-422, a serial communication standard much like RS-232 but with balanced lines. You can buy a simple RS-232 to RS-422 converter if you want to use a standard RS-232 port (e.g. a PC COM port).
The receive and transmit lines can be connected to make a true RS-485 bus, but this requires special care from the PC side, since you have to control the bus direction (e.g. using a dedicated RS-485 board with RS-485 drivers). We recommend using RS-422 for control. Data rate: 115200 bps, 8 bits, with one stop bit and no parity. All data is 8 bit ASCII (ISO8859-1 encoding, but currently any ASCII encoding will do).

Addressing
Each card has a unique identifier called card position, which is assigned (trough hardware pinning) automatically when a card is inserted into a sub-rack. The card positions are numbered from 1 to 10, from a user point of view. From a protocol (or software) point of view, the cards are addressed 0-9, but the user should always see positions 1-10 in menus, etc. Each sub-rack (if you use more than one) should have a unique sub-rack id, numbered 0-7 (user and protocol/software wise), more on this in section 3.4.

3.3 Connecting several sub-racks together

There are two versions of the GYDA-SC Rack System Controller.
GYDA-SC-S for control of a single rack
GYDA-SC-M for control of multiple racks

This section only applies to systems including a GYDA-SC-M Rack System Controller.

Several sub-racks can be connected to each other through the RS-422 ports on the rear.
One GYDA-SC-M controller can control maximum 8 sub-racks.
You start with the sub-rack containing the GYDA-SC-M Rack System Controller, and use 1 RS-422 port to loop through to the next.
The last sub-rack connected must be terminated with 110Ω in order to ensure proper operation. The other port of the rack containing the GYDA-SC controller must be left open, and cannot be connected to other sub-racks.
Figure 5 shows an example of how to connect 8 sub-racks together as seen from the rear end. By using the RS-422 interface at the GYDA-SC-M controller card, we control two RS-422 buses from one card. Each is containing 4 sub-racks. This is more efficient than controlling 8 sub-racks via only one RS-422 bus.

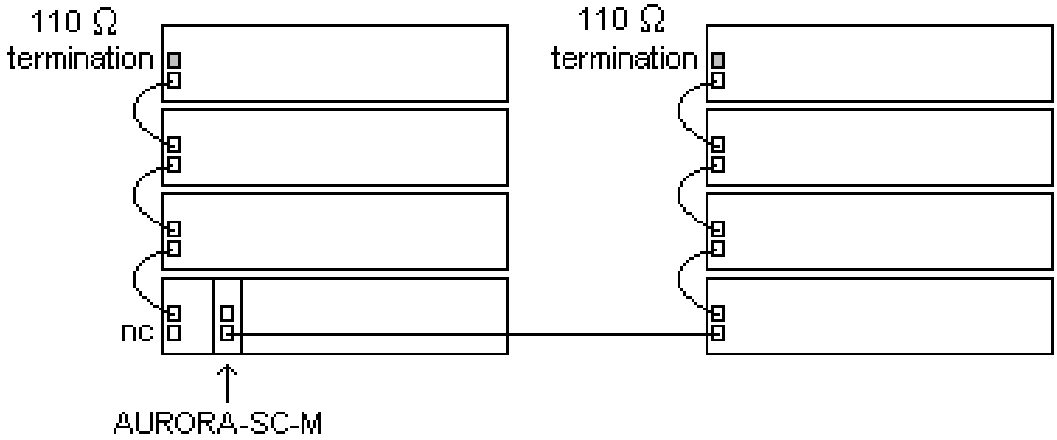


Figure 5 Control of 8 sub-racks with GYDA-SC-M.

3.4 Address setting on each sub-rack

Each sub-rack can be assigned an address through the DIP-switches on the rear. Maximum 8 sub-rack addresses are available.
This address setting only applies when the sub-rack is used in combination with a GYDA-SC-M Rack System Controller.
If you have more than 8 sub-racks together, you need several GYDA-SC-M Rack System Controller cards.

!! In order to ensure proper operation of the system, it is important that no sub-racks controlled by the same GYDA-SC-M Rack System Controller card have the same address set. Reset the sub-rack after reconfiguring the sub-rack system.

The setting of the address of a sub-rack is as follows:

Address:
0 means switch to the right
1 means switch to the left

Address	4	2	1
0	*0*	*0*	*0*
1	*0*	*0*	*1*
2	*0*	*1*	*0*
3	*0*	*1*	*1*
4	*1*	*0*	*0*
5	*1*	*0*	*1*
6	*1*	*1*	*0*
7	*1*	*1*	*1*

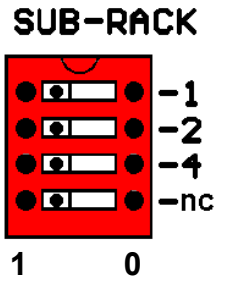


Fig. 6. DIP-switch

The GYDA-SC Rack System Controller automatically detects the position of the cards within each sub-rack.

More detailed information on the RS-422 configuration can be found in a separate document and at our web site: **http://www.network-electronics.com/**

4. Card insertion

In order to reconfigure or expand the number of modules within a sub-rack, the front panel must be removed. Each module has a corresponding connector module at the rear, and is hot swappable.

!! Use safety goggles when hot-swapping module cards. If a receiver card is removed from the sub-rack, an invisible laser beam may be emitted inside the sub-rack from the laser at the other end. The laser beam might be harmful to your eyes.

4.1 Removing the front panel

Detach the front panel by putting your fingers on the right hand side of the front panel and pull gently, as shown in the figures below. Then pull the front panel slightly to the right before removing it.

Figure 7 Removing front panel

A more detailed description of how the front panel is detached is given in figure 8.

Step 1 looks at the details in the "right circle" seen from the right hand side, whereas the next two steps (step 2 and step 3) gives the details of the "left circle" as seen from the top.

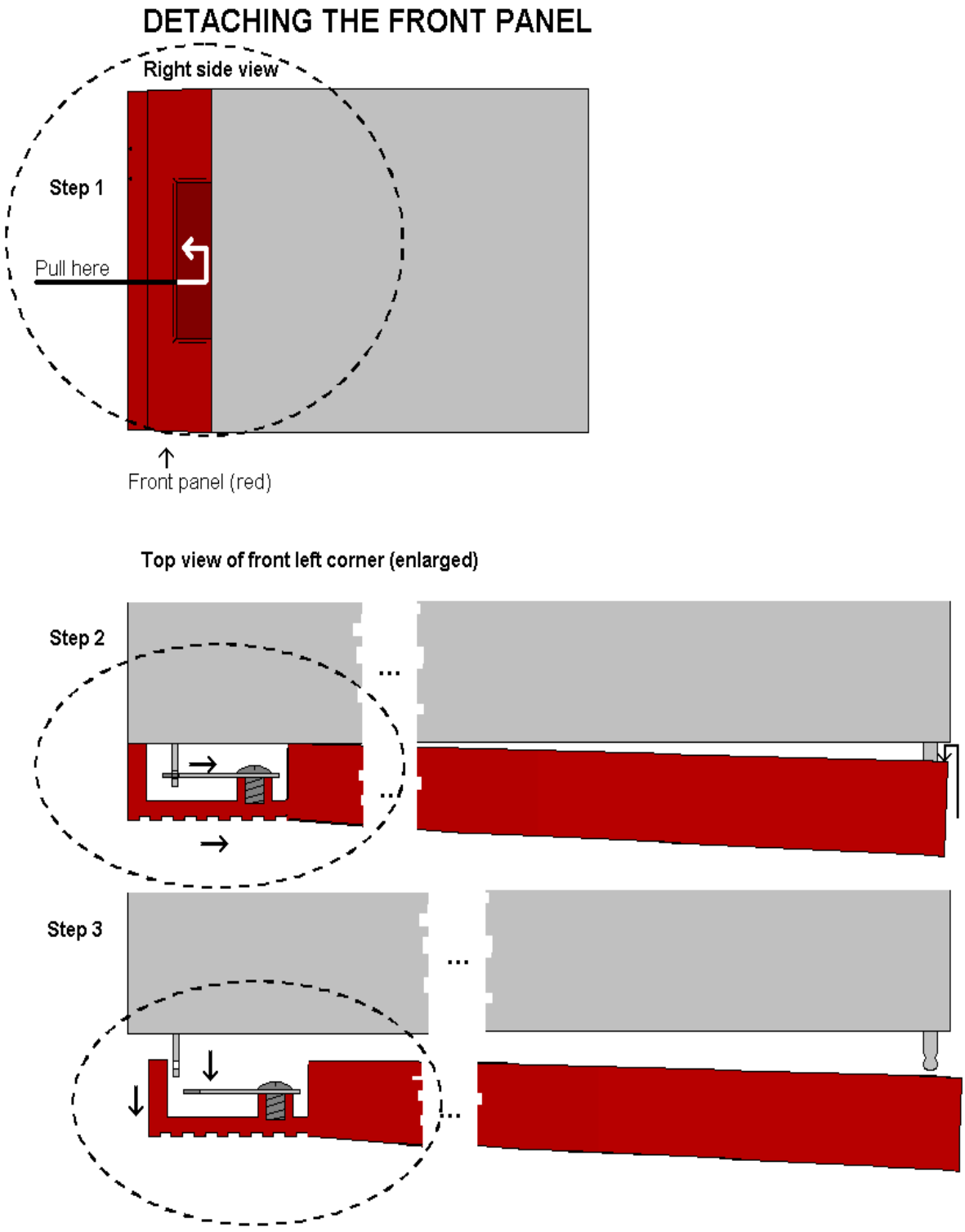


Figure 8 Removing the front panel (continued).

4.2 Card insertion

After the front panel is removed, full access to the card modules inside the sub-rack is given.
Switch off the power with the power switch on the power-supply modules. The green light on the power module is now switched off. If the power supply is redundant, make sure that both power supplies are off.

The sub-racks are equipped with plastic guide rails to align the module cards into their respective positions 1 to 10. Just before the cards are inserted one should remove the plastic cap from the fiber ferrule as shown in figure 9. Do not touch the ferrule tip with your fingers (see section 5.2 - fig. 19).

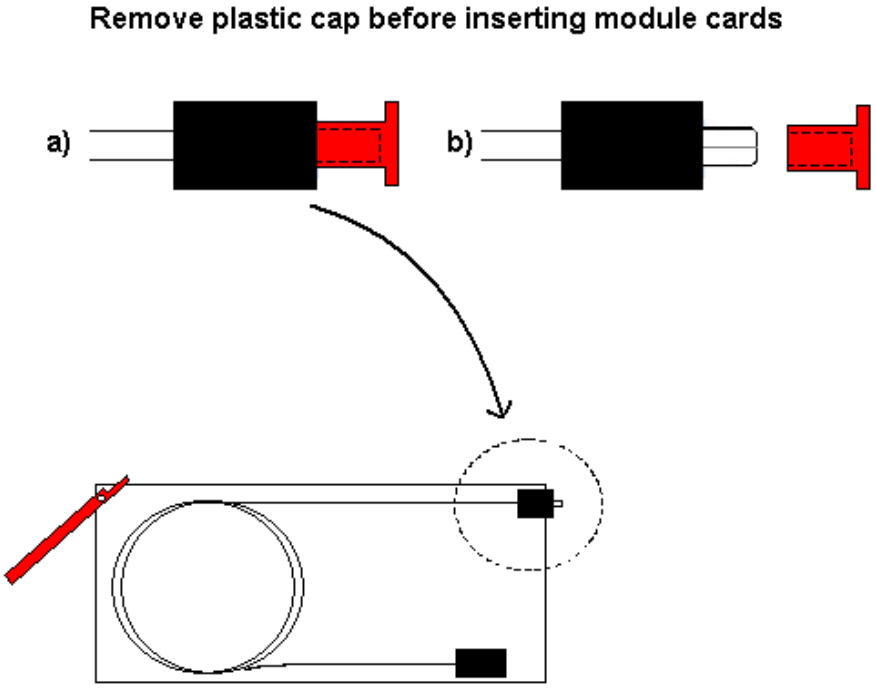


Figure 9 Removal of plastic cap

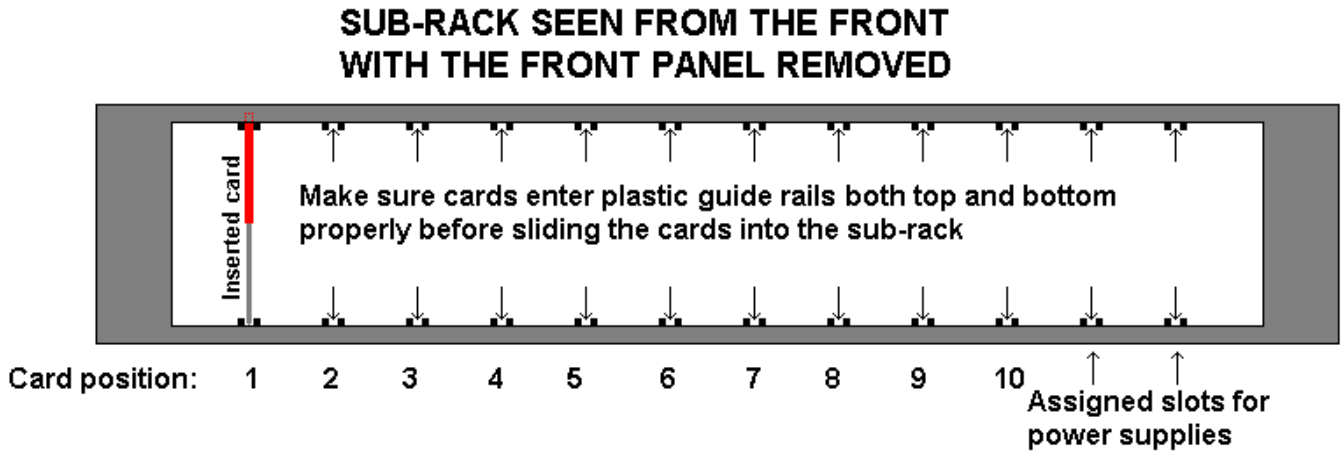


Figure 10 Overview of card positions inside a sub-rack

!! Be careful when inserting the card into the sub-rack. The ferrule of the fiber may be damaged if it touches the sub-rack walls. Do not touch the ferrule tip with your fingers.

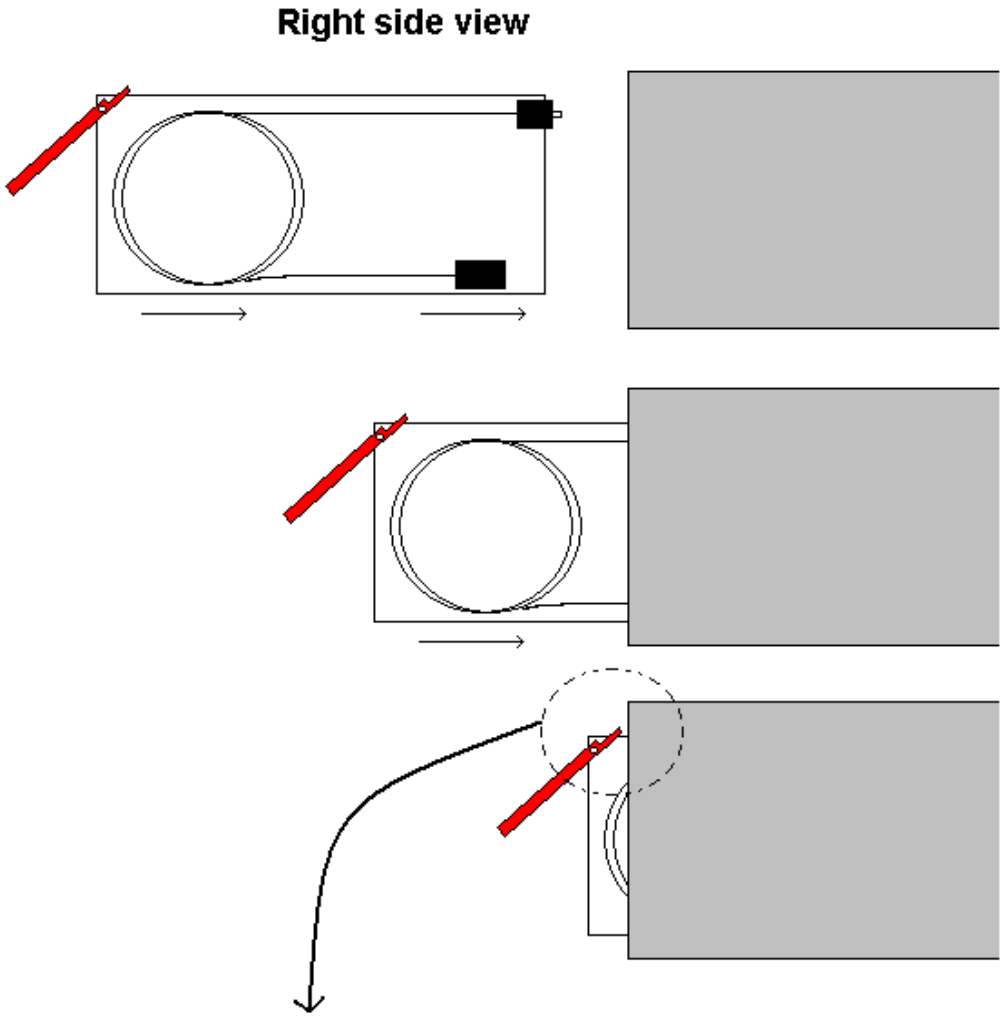


Figure 11 Inserting module cards

Slide the card into the plastic guide rails inside the sub-rack until the red handle is close to the sub-rack front. A detailed description of the last part of the insertion process is shown in figure 12.

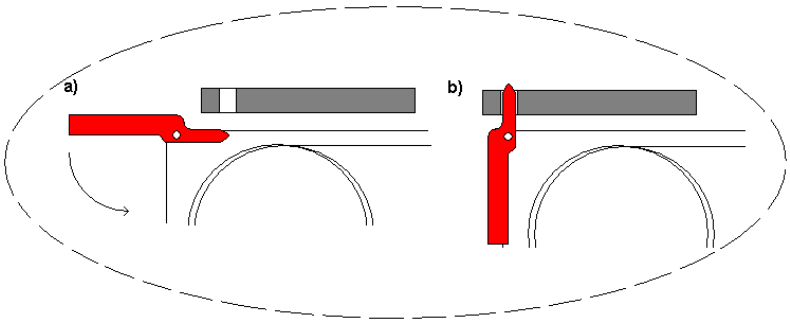


Figure 12 Inserting module cards (continued)

On the top of the rack is a hole above each module slot. When the tip of the handle is just below this hole (fig. 12 a)), start to bend the handle downwards as in figure 12. The tip of the handle enters the hole and the card is locked and proper contact ensured when the handle is in upright position (figure 12 b)).

4.3 Card removal

To remove a module card from the sub-rack frame, release the card by moving the red handle until it is in horizontal position see figure 13 a). Then pull the card out of the sub-rack with the red handle (figure 13 b). After removing a card, it is important that the protective cap is put back on the ferrule tip (figure 13 c) and d).

!! When removing a receiver card from the sub-rack (hot swapping), the laser beam may be present inside the sub-rack (transmitted through the fiber). To avoid damaging your eyes, never look directly into the sub-rack unless you are 100,0 % sure that no laser beam is present inside the sub-rack.

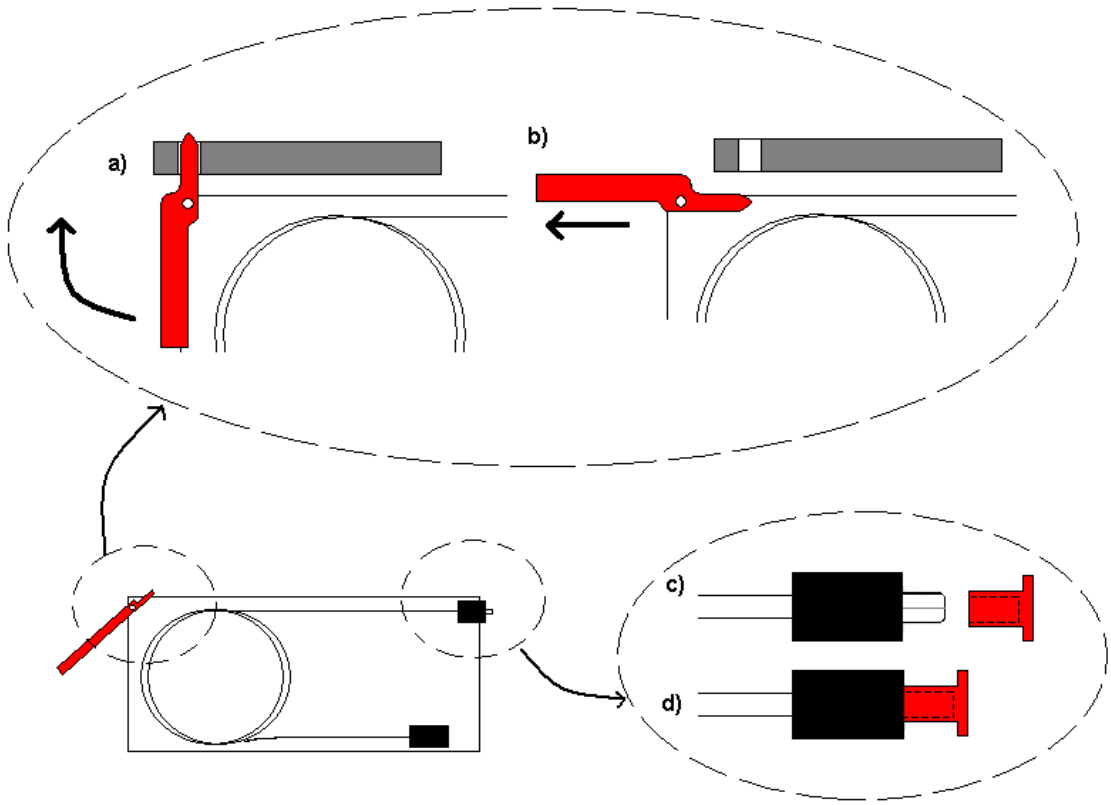


Figure 13: Removal of module card.

4.4 Adding new module cards

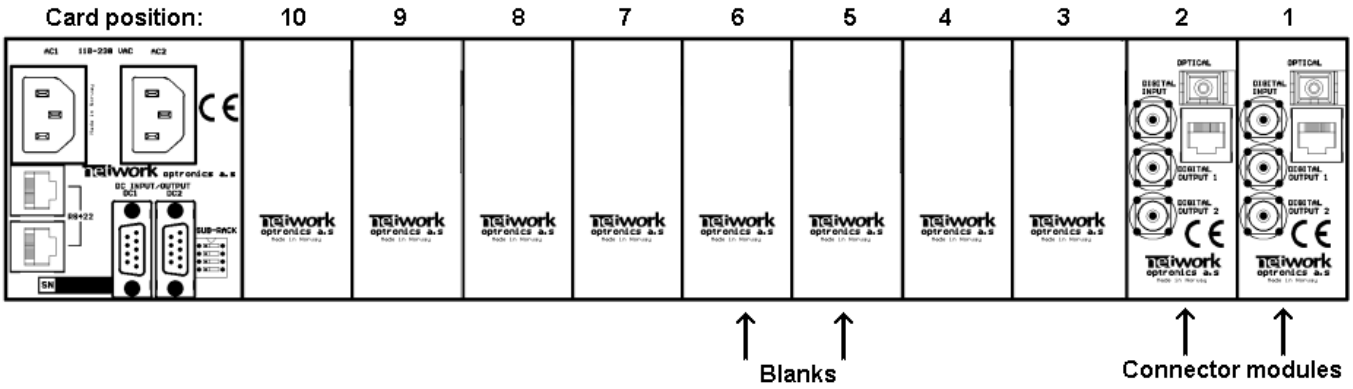


Figure 14 Overview of rear end of sub-rack showing blanks and connector modules

If a sub-rack is not fully equipped, there will be some unused card slots. These slots have no connector modules, but a blank at the rear, as shown in figure 14.

Modules are stacked from position #1 and up to position #10. In figure 14 the next module shall be in position #3. The only exception is the GYDA-SC controller, which shall **always** be in position #10.
Add modules by removing the blanks at the rear and replacing them with the connector module for the new card. A blank has two screws, and a connector module has four screws.

The copper finger strips around the edges of the connector modules and the blanks ensure the EMC-shielding. Care should be taken when removing the modules/blanks, so the finger strip is not torn off. This also applies when inserting the modules / blanks.

The connector modules with an optical interface have a rubber plug inside each connector case to protect from dust. This rubber plug must be removed before the module cards are inserted.

After the connector modules are mounted, the module cards can be inserted as described in section 4.2.

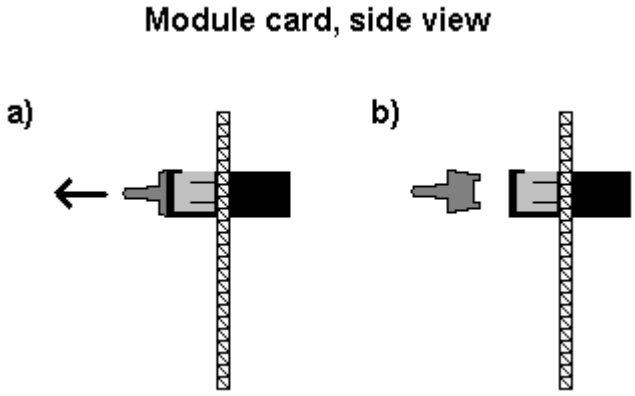


Figure 15 Removing the rubber plug from module cards.

4.5 Attaching the front panel

To attach the front panel, we invert the process described in section 4.1. Start by switching on the power supplies.

Figure 16 Attaching the front panel

We start in the "left circle" and slide the front into the slot as described in figure 17.

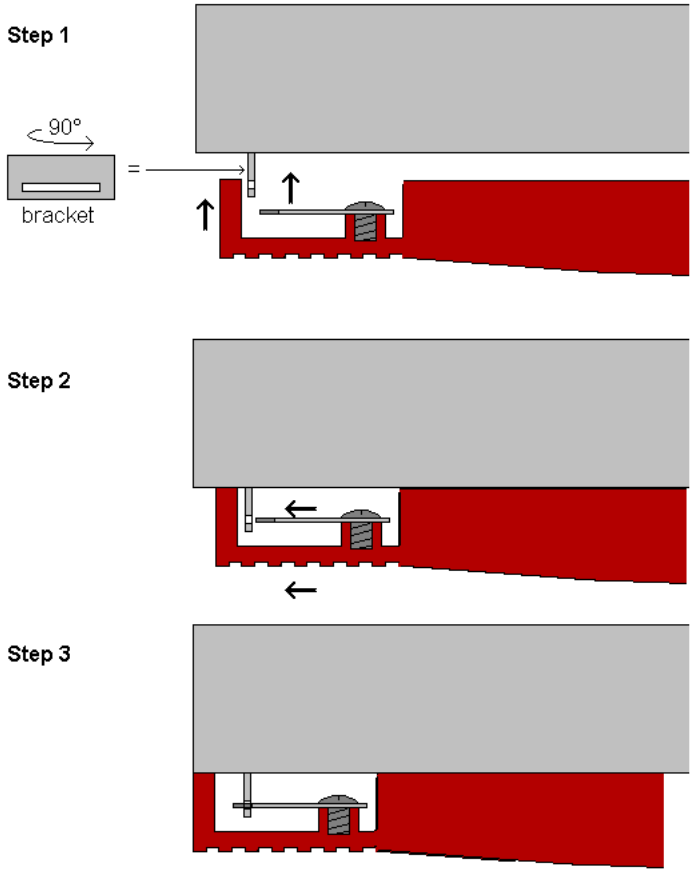


Figure 17 Attaching the front panel (Top view of left corner).

After the front is attached to the left part of the sub-rack we attach in to the right part as shown in figure 18.

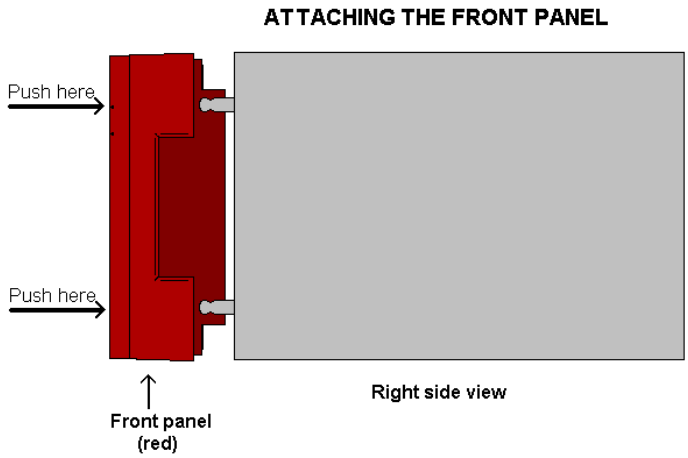


Figure 18 Attaching the front panel (continued)

A click can be heared, and the front is attached.

5. Fiber optics

The FR-2RU-10-2-F houses fiber-optic equipment.

!! When patching at the rear of the sub-rack it is extremely important that you don't look directly into the fiber end. If laser light is emitted this can destroy your eye. As a rule of thumb:
Never look directly into a fiber end. This also applies inside the sub-rack if a module is removed.

Even though a fiber-optic cable can look almost the same as an electrical wire, special care must be taken. Inside the cable is a fiber made of glass. Glass has very different physical properties than the copper used in electrical wires.

5.1 Handling of optical fibres

In practical terms this means that these precautions must be taken:

- Do not bend the fiber too much
- Do not put anything on top of the optical fiber.
- Keep the connectors clean from dust

If a fiber is bent to much, parts of the transmitted light is lost.
We can compare light transmission through an optical fiber with driving a car at maximum speed. We want the road to be as straight as possible. The probability that your car is still on the road at the other end of the turn decreases with increasing curvature of the turn. However, there is a major difference. The transmitted light is gradually lost when the curvature increases, while your car is either on the road, or not.

Therefore all the datasheets of optical fibres have a point called "minimum bend radius" or something similar. This means that any bending of the fiber corresponding to a bend radius less than the given value, will make the light leak out of the fiber.
A typical value is 20 mm to 40 mm (Bellcore standard) for single mode fibres.

You should also avoid putting any heavy items on top of the optical fibres, because this will change the optical properties of the fiber, and contribute to errors in the transmitted signal.
Unless the fiber is damaged, it will regain its optical properties after a bend is straightened out or the items are removed / the squeeze is released.

5.2 Fiber-optic Connector

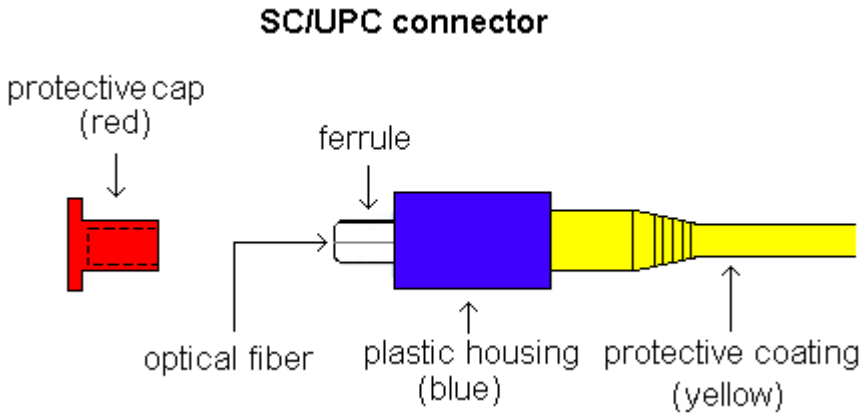


Figure 19: The different parts of an SC/UPC Connector.

The flashlink product range utilises SC/UPC connectors. These connectors have a return loss better than 40 dB typ.

As compared to an electrical connection between two points, an optical connection is much more dependent on clean connectors. A dirty connector can add up to 10 dB of attenuation to your link. Either you have light entering the receiver or you have not. If there is no light at the receiver, then no signal will be detected. So the difference between an errorless connection over fiber, and no connection at all can be a dirty connector. To protect the connectors from dust, one shall always put on the plastic cap (red or other colour), which is on the connector end at delivery whenever a fiber end is disconnected.

If there is a chance that the fiber connector is dirty, one should clean the connector before putting it close to a clean fiber ferrule. If a clean connector is pressed against a dirty connector, both connectors will become dirty resulting in degradation of signal quality. Or even worse, you may damage the surface of the connectors.
Therefore: Clean connectors are of crucial importance.

5.3 Laser safety precautions

Guidelines to limit hazards from laser exposure.

All the available EO units in the flashlink® range include a laser.
Therefore this note on laser safety should be read thoroughly.
The lasers emit light at 1310 nm or 1550 nm. This means that the human eye cannot see the beam, and the blink reflex cannot protect the eye. (The human eye can see light between 400 nm to 700 nm).

A laser beam can be harmful to the human eye (depending on laser power and exposure time), therefore:

!! BE CAREFUL WHEN CONNECTING / DISCONNECTING FIBER PIGTAILS (ENDS).

NEVER LOOK DIRECTLY INTO THE PIGTAIL OF THE LASER/FIBER.

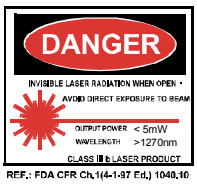
NEVER USE MICROSCOPES, MAGNIFYING GLASSES OR EYE LOUPES TO LOOK INTO A FIBER END.

USE LASER SAFETY GOGGLES BLOCKING LIGHT AT 1310 nm AND AT 1550 nm.

Instruments exist to verify light output power: Power meters, IR-cards etc.

Flashlink® features:
The FR-2RU-10-2 is classified as Class 1 laser product according to EN 60 825-1:94/A11:96, and CFR Ch1(1997) Part 1040.10.
If the front panel is removed, the FR-2RU-10-2 is classified as Class 1 laser product according to EN 60 825-1:94/A11:96, and class IIIb according to CFR Ch1(1997) Part 1040.10.

Maximum output power: 5 mW.
Operating wavelengths: 1310 nm or 1550 nm.



6. flashlink® control protocol

6.1 Document conventions

All commands sent to the card are printed in *italics*.
This is a command sent to a card.
All responses sent from a card to the controller are printed in **bold**.
This is a response sent from a card to the controller.

6.2 Hardware interface

The hardware interface is basically RS-422, a serial communication standard much like RS-232 but with balanced lines. You can use a simple (dumb) RS-232 to RS-422 converter if you want to use a standard RS-232 port (eg. a PC COM port).
The receive and transmit lines can be connected to make a true RS-485 bus, but this requires special care from the PC side, since you have to control the bus direction (e.g. using a dedicated RS-485 board with RS-485 drivers). We recommend using RS-422 for control.
Data rate: 115200 bps, 8 bits, with one stop bit and no parity.
All data is 8 bit ASCII (ISO8859-1 encoding, but currently any ASCII encoding will do since no special ASCII characters are used).

6.3 Addressing

Each card has a unique identifier called card position, which is assigned (trough hardware pinning) automatically when a card is inserted into a subrack. The card positions are numbered from 1 to 10 from a user point of view. From a protocol (or software) point of view, the cards are numbered 0-9. When we refer to card position in this document, we refer to this "low level id" numbered 0-9, but the user should always see positions 1-10 in menus, etc.
Each subrack (if you use more than one) should have a unique subrack id, numbered 0-7 (user and protocol/software wise). The id is set by DIP switches on the rear of the rack, behind the power supply.

6.4 General command structure

Each command is built up of a sequence of ASCII characters terminated by linefeed. The first two characters are the source adress (source subrack id and the source card position).
Frame structure:

Byte 0	Rack id (0-7) Destination
Byte 1	Card pos (0-9) Destination
Byte 2	Rack id (0-7) Source
Byte 3	Card pos (0-9) Source
Byte 4-n	command or command response
Byte n+1	linefeed (10 decimal, 0x0A hex)

If the command or command response contains a line feed, it is preceded by a backslash (\).

6.5 Card detection (hot swap)

The controller must send a "hello" command to gain control over a board, this is to make sure that the control software is aware of any card changes. After a power up or hot swap, the card does not respond to any other command than hello.

6.6 Hello command

This command establishes communication with a new unit. An example of communication with SDI-EO and SDI-OE is shown in the following. The command is short (a single question mark) to save bandwidth. The card will respond with card info. If the card is not present, the command times out. A typical response would be:
0409?
0904EO/SDI/1310nm,-7.5dBm
hw rev 1.0
sw rev 1.0
protocol ver 1.0
This is an electrical to optical converter for SDI, with a -7.5dBm 1310nm laser. The hardware revision is ver 1.0, and the software version is ver 1.0. The protocol version is 1.0.

6.7 Electrical to optical converters

6.7.1 Hello command

An EO converter will respond to a hello command with:
0409?
0904EO/SDI/1310nm,-7.5dBm
hw rev 1.0
sw rev 1.0
protocol ver 1.0
or
0409?
0904EO/T140/1310nm,-7.5dBm
hw rev 1.0
sw rev 1.0
protocol ver 1.0

6.7.2 Info command

The card will respond to the command string "info" by sending the card status. This is a typical example.
0409info
0904laser on
SDI signal strength = 81 %
vcc = 5.04 V
laser fail: no

6.8 Optical to electrical converters

6.8.1 Hello command

An OE converter will respond to a hello command with:
0409?
0904OE/SDI/reclocking,not calibrated
hw rev 1.0
sw rev 1.0
protocol ver 1.0
or
0409?
0904OE/T140/reclocking,not calibrated
hw rev 1.0
sw rev 1.0
protocol ver 1.0
"Not calibrated" refers to the optical power measurement which is not calibrated.

6.8.2 Info command

The card will respond to the command string "info" by sending the card status. This is a typical example.
0409info
0904signal = -12.2 dBm
optical signal: yes
reclocker locked: yes
vcc = 4.97V
Note that since the optical signal strength is not calibrated, the measurement will be wrong (typ. +/- 5 dB).

Declaration of conformity with CE

This apparatus meets the requirements of EN 55103-1 (November 1996) with regard to emissions, and EN 55103-2 (November 1996) with regard to immunity; it thereby complies with the Electromagnetic Compatibility Directive 89/336/EEC.

General environmental requirements for flashlink and ConQuer equipment

1. The equipment will meet the guaranteed performance specification under the following environmental conditions:

- Operating room temperature range 0°C to 50°C
- Operating relative humidity range up to 90% (non-condensing)

2. The equipment will operate without damage under the following environmental conditions:

- Temperature range -10°C to 55°C
- Relative humidity range up to 95% (non-condensing)

3. Electromagnetic compatibility conditions:

- Emissions EN 55103-1 (Directive 89/336/EEC)
- Immunity EN 55103-2 (Directive 89/336/EEC)