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December 11th, 1998

Stream 01
Issue 02

IMW029**

INSTRUCTION MANUAL FOR THE ENHANCED INTEGRATED SUBRACK AMPLIFIER

Originator/site: I BARRETT - PAI01

Function: PRODUCT ENGINEER

Applicable Products:

Product Engineering Code	Common Product Code
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NTW029DC	A0686090

Nortel plc
Optoelectronics
Paignton
Devon
ENGLAND

Advanced Technology
Advanced Technology Laboratory
Ottawa
Ontario
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GF069/11

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103-3946	00 02	ECR1169 - Change to page 8 note 3 - Equipment fuse type changed to 1.25A Antisurge.

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1.0 INTRODUCTION

This document describes the mechanical and electrical interfaces of the Enhanced Optical Subrack Amplifier and how to use them. Details of the optical performance will depend on exactly which amplifier option has been chosen and can be found by reference to the appropriate optical data sheet.

The specification of the Enhanced Optical Subrack Amplifier, or Type-119 is defined by its product code as follows:

- FA18UFDC-119EC28

Table 1 describes the meaning of the various configuration options available with the subrack.

Table 1: Picture code explanation.

Code	Option
FA14U	14dBm low noise figure amplifier
FA17U	17dBm low noise figure amplifier
FA17S	17dBm soft fail amplifier
FA18U	18dBm low noise figure amplifier
F	Front mounted fibre exit
R	Rear mounted fibre exit
AC	110V / 240V switchable mains powered rack
DC	48V DC powered rack
E	ETSI standard footprint rack (no E signifies 19” standard footprint)
C28	SC-SPC receptacled connector
C33	FC-SPC receptacled connector
C45	FC-APC receptacled connector (2mm key)
C49	SC-APC receptacled connector

Not all the information of this manual will be relevant to all amplifier configurations. This manual describes the mechanical layout of the Type-119 subrack, the type, position and pin-out of the electrical and optical inter-connects and the interface protocol through the front panel and over remote or local serial comms.

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2.0 HEALTH & SAFETY

2.1 Optical Safety.

This product contains Class 3B lasers but when used in a closed circuit optical system as intended the Amplifier is a Class 1 laser products as defined in IEC825-1:1993, EN60825-1:1994 and in the USA code of Federal Regulations CFR1040.10.

Class 3B laser emissions can cause almost instantaneous and permanent damage to the eye. An interlock switch is provided on the optical connector access cover which removes power from the laser when the cover is opened. However as other parts of the user's system may not be interlocked it is recommended that no optical connector in the system is opened or viewed while the equipment is enabled.

Although, according to IEC 825-1, a fibre optic telecommunications system is class 1 when in it's normal operating mode (as all radiation is enclosed by optical fibres), this does not give an indication of the potential hazard that might exist from a broken fibre or a disconnected fibre termination. IEC 825-2 (Safety of Optical Fibre Communication Systems) deals specifically with this and provides a system of hazard levels. It should be noted that, when fitted with a class 3B EDFA, this unit is capable of producing class 3B hazard levels at locations within the users system. Appropriate precautions, as defined in the standard, must be taken. These include installation of equipment in controlled locations, appropriate warning signs and labels, and designing connectors such that a tool is needed for disconnection.

Power to the equipment is controlled by a key operated switch. In their own interests users must restrict the use of keys to suitably qualified persons only. In the event that it is necessary to open the optical connectors it is recommended that the system is disabled and then powered down via the key operated switch.

2.1.1 Warning Laser Devices Intrinsic Properties.

Radiation from semiconductor laser diodes may be sufficiently intensive to cause almost instantaneous damage to the eye. Each application must be considered hazardous until proven safe. This needs careful consideration of power emitted, radiation angle of divergence or confinement of radiation within optical fibres or other physical constraints. Since the radiation is in the non visible (infra red) portion of the spectrum, precautions must be taken to avoid the accidental viewing of the light source.

2.1.2 Class 3B Laser Products for Laboratory and Workshop Laser Installations.

Class 3B lasers are potentially hazardous if a direct beam or spectral reflection is viewed by the unprotected eye (intrabeam viewing). The following precautions should be taken to avoid direct beam viewing and to control spectral reflections.

(a) The laser should only be operated in a controlled area.

(b) Care should be exercised to prevent unintentional spectral reflections.

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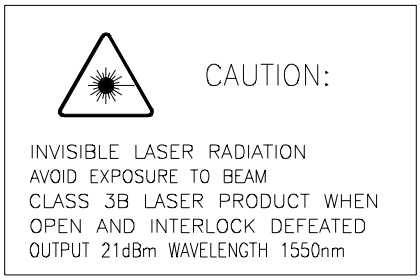
(c) The laser beam should be terminated where possible at the end of its useful path by a material that is diffuse and of such a colour and reflectivity as to make beam positioning possible while still minimising the reflection hazards.

NOTE - Condition of safe viewing of diffuse reflections for Class 3B visible lasers are a minimum viewing distance of 13cm between screen and cornea and a maximum viewing time of 10s. Other viewing conditions require a comparison of the diffuse reflection exposure with the MPE.

(d) Eye protection is required if there is any possibility of viewing either the direct or spectrally reflected beam, or of viewing a diffuse reflection not complying with the conditions of item c).

(e) The entrances to areas should be posted with a standard laser warning sign as shown in Fig. 1.

Figure 1 : Laser warning classification.



The above precautions are taken from IEC 825-1:1993. The user should always consult with the latest issue of relevant standards to determine their own safety precautions.

2.2 Electrical and Fire.

External materials meet UL94V1 or better, with an oxygen index of 28% or more.

The equipment build standard complies with the requirements of IEC950, EN60950, UL950 and CSA C22.2 No.950.

2.3 EMC.

The equipment complies with the requirements defined in the following documents:

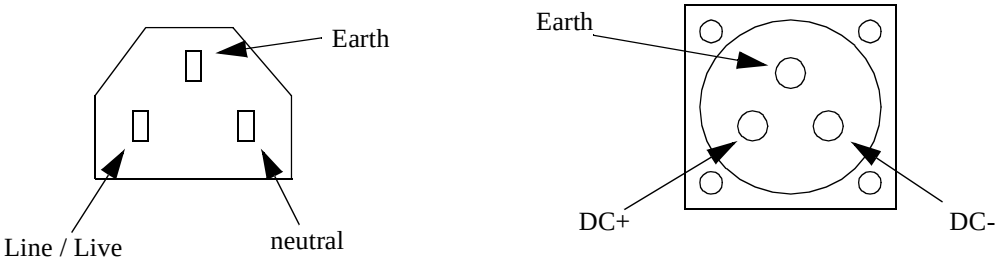
- EN55022/CISPR 22, CLASS b; Conducted and radiated emissions
- IEC801-2, 1000-4-2, EN61000-4-2; ESD
- IEC801-3, 1000-4-3, EN61000-4-3; Radiated Field Immunity
- IEC801-4, 1000-4-4, EN61000-4-4; EFT
- IEC801-5, 1000-4-5, EN61000-4-5; Lightning surge immunity
- Bellcore GR-1089-CORE; modulated radiated field immunity.

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2.4 Electrical Safety Notice.

The supplied unit should be connected as specified in Fig. 2 below. The connectors are as viewed from the rear of the device.

Figure 2 : Electrical connections for the Type-119 subrack.



AC version

connector: standard IEC inlet

DC version

connector: Framatome 3way crimp
UTG-6/10/03SNVDE

Electrical safety may be impaired if the connections shown in Fig. 2 above are not observed. For the DC version, either DC+ or DC- should be connected to Earth.

Table 2 specifies the supply voltage limits for both power supply variants.

Table 2: Supply voltage limits.

Parameter	Symbol	Min	Typ	Max	Units	Notes
DC Power Supply Voltage	Vdc	36	48	76	V	1
DC Power Supply Current	Idc		0.25	0.6	A	1
AC Power Supply Voltage (110V selected)	Vac	90		130	V	2, 3
AC Power Supply Voltage (240V selected)	Vac	207		253	V	2, 3
AC Power Supply Current (110V selected)	Iac		0.4	0.75	A	2
AC Power Supply Frequency	Fac	47		63	Hz	2

Notes:

1. Refers to DC powered unit.
2. Refers to mains powered unit.
3. Damage may occur if the AC unit is used with the wrong voltage range selected

Equipment fuse: H 250V 1.25A Antisurge.

To ensure continued protection against fire replace only with the specified type and rating of fuse.

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3.0 SHIPPING AND PACKAGING DETAILS

Each unit is packed in a corrugated cardboard box, supported by foam inserts. All packaging has been specifically designed to be reusable. The contents of the packing case are as follows:

- Type-119 Optical Amplifier Subrack
- 2 keylock keys
- 2 spare fuses
- User Guide
- Deliverable data

The subrack is shipped with markings to aid traceability and give safety information to the user. These labels state:

- Manufacturer's name and address.
- Device type, serial number & date code.
- FCC declaration.
- EN60825 laser warning labels situated on the outside and inside of the fibre cover.
- The usable voltage range & rated current in amps.
- Fuse type with voltage and current rating and the text: "CAUTION: For continued protection against risk of fire, replace only with the same type and rating of fuse."
- Identification of input and output optical ports.
- Identification of front and rear panel connectors.
- CE & UL recognition mark.

In addition, the packing case is marked with the following:

- Manufacturer.
- Country of Origin.
- Safety information.
- Device type.
- Serial number & date code.
- CE compliance.

3.1 Screening.

All product is calibrated and tested for optical and electrical performance before shipping.

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4.0 DESCRIPTION

The Type-119 subrack is specified for use in optical transmission systems. It consists of an electronic control and monitoring system which monitors the status of the optical and electrical components within the subrack. This information is used to adjust the control parameters to maintain the required performance. A set of digital electrical connections enable external control of the subrack, continuous monitoring of its performance, and provide dry contact voltless relay outputs for alarm states. The unit complies with CE Class B and UL requirements.

A brief list of the features is outlined below:

- 19” or ETSI compliant 1U rack mounted design.
- Accommodates dual pump soft fail EDFA.
- 48V DC or Mains PSU options.
- Interlocked fibre exit at front or rear.
- RS485 daisychain interface on rear.
- RS232 craft interface on front panel.
- Voltless dry contact relay alarm signals on rear.
- 2 line by 24 character LED display, with selection buttons for displaying:
    - Input / Output Power.
    - Status of alarms.
    - Electrical and optical monitors.
    - Password protected configuration options.
- Front panel status LED.
- Front panel key switch.

Fig. 3 gives an external view of the product, while Fig. 4 shows a block diagram of the complete amplifier subrack.

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Figure 3 : Type-119 amplifier outline drawing.

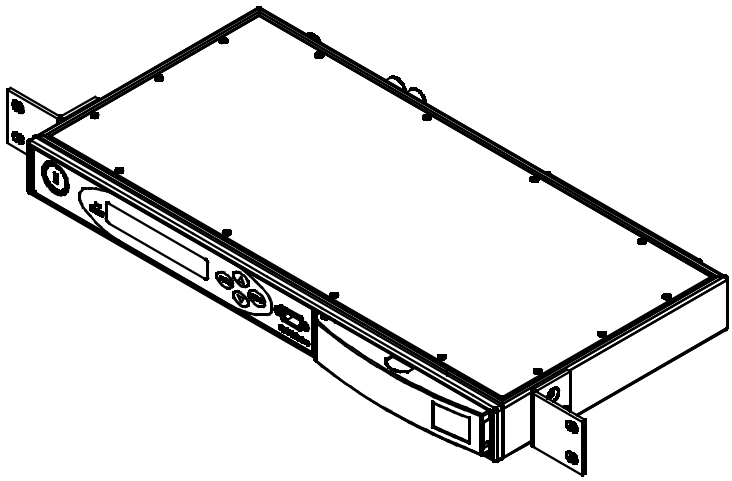
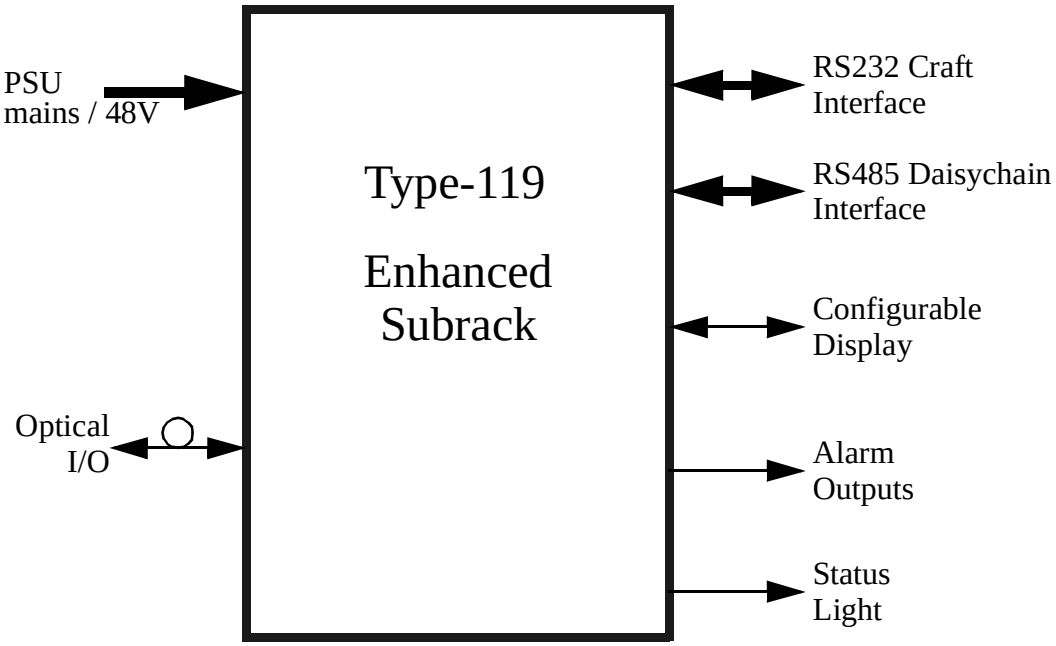


Figure 4 : Block diagram of the Type-119 subrack.



5.0 EXTERNAL SPECIFICATIONS

This section describes the interface specifications of the Type-119 subrack. For the optical performance please refer to the relevant optical component data sheet.

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Absolute maximum ratings are those ratings above which the devices performance and reliability may be impaired. The meeting of optical and electrical specifications is not implied when the device is subjected to the absolute maximum ratings. The maximum ratings are shown in Table 3.

Table 3: Absolute maximum ratings.

Parameter	Symbol	Min	Max	Unit	Notes
Storage Temperature	Tstg	-20	70	degC	
Operating Temperature	Top	-5	50	degC	
DC Supply Voltage	Vdc		76	Vdc	1
AC Supply Voltage	Vac		265	Vac	2

Notes:

1. Refers to DC powered rack.
2. Refers to AC powered rack.

The operating voltages are given in table 2.

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A summary of all the connections incorporated in the design are described in Table 4.

Table 4: Electrical and optical interfaces.

Parameter	Connection	Description
Front Panel Interface	2x24 character LCD display plus 4 selection buttons	Displays information of unit status, indicates alarm states and offers a limited amount of configuration.
RS232 Craft Interface	9 pin female D-type connector	Front panel connection for detailed local analysis and configuration.
Status Light	Three colour LED	Gives instant status information on the unit - OK, Minor alarm or Major alarm.
Master Switch	Key switch	Ensures only authorised individuals (with access to key) can turn the instrument on or off.
Optical Input(s)	Optical back-to-back	Customer defined back-to-back connection. Up to 2 inputs available dependent upon optical component.
Optical Output(s)	Interlocked optical back-to-back	Electrical interlock guards access to fibres to eliminate possibility of eye exposure to high optical powers. Up to 2 outputs available dependent on optical component.
RS485 Daisy-chain	1 male 9 pin D-type connector & 1 female 9 pin D-type connector	Double serial connection for easy daisychaining of amplifiers, located on the rear of the unit.
Alarm Outputs	15 pin female D-type connector	Gives dry contact relay closure outputs for alarms plus some test lines on the rear panel.
AC Volts Input	IEC Mains socket	For power input on mains models.
DC Volts Input	Framatome 3 pin male connector	For power input on 48V DC models.

5.1 Alarm Indications

This section details the alarms and monitors that give status information to the user. There are 4 main methods for displaying status information:

- Status LED
- Alphanumeric LCD
- RS232 / RS485 serial comms
- Voltless Dry Contact Relay outputs

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Details of each of these is given in later sections of this document. Table 5 gives an overview of each alarm state and how the subrack uses these status indicators to display them.

Table 5: Alarm conditions for Type-119 subrack.

Alarm	LED	LCD	RS232 / RS485 (note 3)	Relay	Cause
PSU	off	off	-	Major & Minor	Supply failure
PWR	red	PWR FAIL	(AS) PWR (LS[1,2]) PWR	Major	Optical output out of limits
LOS	red	LOS ON	(AS) LOS	Major	Optical input too low (note 1)
FIB	red	FIB OPEN	(AS) FIB	Major (note 2)	Fibre interlock open (note 1)
Tint	red	Tint FAIL	(AS) TINT	Major	Internal temperature exceeded absolute limits (note 1)
	yellow	Tint FAIL	(AS) TINT	Minor	Internal temperature outside preset limits
Tlas	red	Tlas FAIL	(LS[1,2]) TLAS	Major	Laser temperature exceeded absolute limits (note 1)
	yellow	Tlas FAIL	(LS[1,2]) TINT	Minor	Laser temperature outside preset limits
Idrv	yellow	Idrv ON	(LS[1,2]) IDRV	Minor	Laser drive current outside preset limits
FPA	green	OK	(AS) FPA	-	Front Panel Access permitted
Config	yellow	-	-	-	Configuration menu on LCD entered

Notes:

1. This alarm causes the unit to shutdown by disabling the drive to the laser(s). The unit will reply DISABLED to an AS command on the serial comms.
2. When the FIB alarm is on, the Minor Relay is never activated.
3. The table gives the serial comms response to the command in brackets when the alarm is activated. With the alarms disabled, the response is always OK, however, all other alarm indications remain (LED, LCD, Relays) and shutdown still occurs if the alarm dictates that it should. The reply to the command AL is DISABLED to signify the alarms have been disabled.

The alarms available on the unit can be grouped into two areas, those which signify a system or unit failure (Major alarms) and those that give warning the unit may be operating outside its specified range (Minor alarms). Not all alarms will be relevant to all configurations.

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MAJOR ALARMS:

- PSU - Power Supply Alarm - Power supply failure to the unit. All indications will switch off, however the relays will signify a failure.
- PWR - Optical Power Alarm - Activated when optical output power (or other drive condition) has not achieved the pre-set value.
- LOS - Loss Of Signal Alarm - Activated if optical input power falls below a preset level.
- FIB - Fibre Interlock Alarm - Activated if the fibre interlock cover is open. This will also cause the optics to be disabled, raising other alarms.

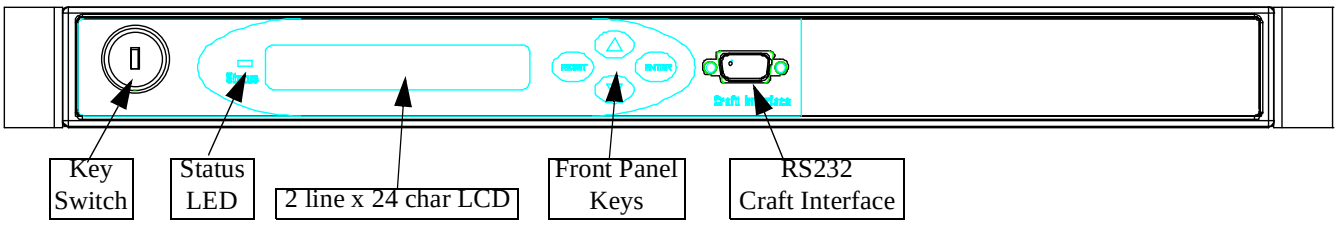
MINOR ALARMS:

- Tint - Internal Temperature Alarm - Activated to show the internal temperature of chassis has risen above 55°C.
- Tlas - Laser Temperature Alarm - Activated when the pump laser submount temperature is not being maintained.
- Idrv - Laser Drive Current Alarm - Activated where the pump laser drive current in the Gain Block is required to exceed a pre-set limit in order to achieve the required output power.
- FPA - Front Panel Access Flag - Set when access to the Configuration Menu is permitted through the front panel keys. A password is still required to access this menu.

5.2 Front Panel Connections

This section describes in more detail the elements on the front panel of the Type-119. Fig. 5 shows the layout of the front panel, the fibre exit is assumed to be on the rear of the unit.

Figure 5 : Type-119 Front Panel.



5.2.1 Front Panel LCD & Keys

The unit contains a 2x24 character backlit LCD configured by using four keys to dispense information about the device and its set-up. There are three main display areas - Default Screen, Main Menu and Configuration Settings. All information and settings can be accessed by following the on-screen menus and selecting the appropriate soft key button.

Details of the display menus and how to access them is contained in Appendix A. Below is an overview of the display properties.

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DEFAULT SCREEN

The exact information given in the Optical Status mode will depend on the optical component. Below is a typical list of the status items:

- Pout - Output Power.
- Pin - Input Power.
- Overall Alarm Status

MAIN MENU

By accessing the Main Menu, the status of the monitors and alarm function can be toggled through in more detail.

CONFIGURATION SETTINGS

By entering a user password, access can be gained to a configuration menu where a small number of parameters can be changed. These include:

- Adjustment to Optical Output Power.
- Alarm enable / disable.
- Address number of the unit.
- Contrast of the Display.

Access to the front panel configuration menu can be enabled or disabled remotely over the system's serial link. When enabled the FPA - Front Panel Access flag (visible over the serial comms) is asserted. Any access through the front panel causes the Status Light to turn yellow.

5.2.2 Front Panel RS232 Craft Interface

A female 9-pin D-type serial link connector is provided on the front panel for diagnosis and reconfiguring the unit once installed. Details of the serial interface protocol can be found in Appendix B. Below is an overview of the comms properties.

Data that can be viewed on the interface includes:

- Optical Input and Output Power
- Electronic and Optical monitors
- Alarm Status (see Section 5.1)

Settings that can be altered include:

- Optical Output Power
- Alarm enable / disable
- Front Panel Access enable / disable

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The Pin-out of the connector is shown in Table 6.

Table 6: Pin-out of 9way female D-type RS232 Craft Interface.

Pin	Connection	Pin	Connection
1		6	
2	RS232 Data Out	7	
3	RS232 Data In	8	
4		9	
5	Signal GND		

5.2.3 Status Light

The front panel contains an LED to signify at a glance the current status of the subrack. The LED has three states, as described in Table 7.

Table 7: Status Light States.

State	Signifies
GREEN	Unit is operating OK. No alarms have been raised.
YELLOW	Minor Alarm has been raised, unit may be operating outside normal conditions
RED	Major Alarm has been raised, unit is not functioning correctly.

In normal operation the status is GREEN. When an alarm is raised, the status will change. The cause of a status change can be found by interrogating the individual alarm outputs, either via the front panel display or one of the serial interfaces.

A full list of the Major and Minor alarms is given in section 5.1.

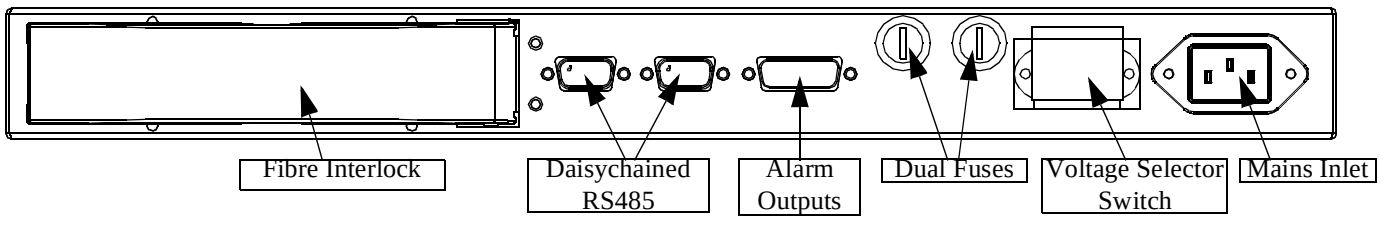
5.2.4 Key Switch

A key switch is provided on the front panel to ensure the unit can only be powered up or down by authorised personnel. Two keys are provided with the unit.

5.3 Rear Panel Connections

This section describes in more detail the elements on the rear panel of the Type-119. Fig. 6 shows the layout of the rear panel, assuming rear fibre exit and mains power.

Figure 6 : Type-119 Rear Panel.



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5.3.1 Optical Connectors

The optical input and output are via back-to-back adaptors mounted behind the fibre cover and protected by an interlock. This will interrupt the power to the optics when opened ensuring there can be no exposure to excessive levels of laser radiation during installation or optical cleaning. This is not the recommended method of turning off the optics, and in all cases the unit should be powered down before the cover is opened to avoid the possibility of damaging the laser.

The type of back-to-back adaptor used is defined by the customer.

The design of the optical interface is such that it allows cleaning of all input and output connectors whilst the unit is installed.

5.3.2 RS485 Daisychain

The rear of the subrack has two 9 pin D-type connectors for RS485 serial communication. The first is a 9 pin male D-type and the second a 9 pin female D-type to enable up to 32 Type-119 units to be daisychained together. This serial busing allows all the connected amplifiers to be monitored and / or configured remotely through serial network management links to a Network Management Centre. In this way, devices can be reconfigured without any local action.

The information available over the RS485 bus is the same as that supplied through the RS232 interface on the front panel (see Section 5.2.2). The pin designations of the connectors are shown in Tables 8 and 9.

Table 8: Male 9 pin D-Type Connector Pin-Out.

Pin	Connection	Pin	Connection
1		6	Signal GND
2		7	
3	RS485 Data in/out -	8	
4	RS485 Data in/out +	9	
5			

Table 9: Female 9 way D-Type Connector Pin-Out.

Pin	Connection	Pin	Connection
1		6	Signal GND
2		7	
3	RS485 Data in/out -	8	
4	RS485 Data in/out +	9	
5			

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5.3.3 Alarm Outputs

The third D-type connector on the rear panel is a 15 way male used to output alarm information. By using voltless dry contact relay outputs, electrical isolation in excess of 1kV between the amplifier unit and any other piece of equipment is ensured. Fig. 7 shows the layout of connections and Table 10 gives a pin-out for the D-type.

Table 10: Male 15 pin D-type Connector Alarms Pin-out.

Pin	Symbol	Description	Pin	Symbol	Description
1	Std in	Standard load input	9	Std ret	Standard load return
2	Isol ret 2	Isolated return line 2 (cathode)	10	Isol i/p 2	Isolated input line 2 (anode)
3	Isol ret 1	Isolated return line 1 (cathode)	11	Isol i/p 1	Isolated input line 1 (anode)
4			12	Minor hi	Unit operating out of range
5	Minor lo	Unit operating within range	13	Minor com	Minor Relay Common
6			14	Major hi	Unit not operating
7	Major lo	Unit operating	15	Major com	Major Relay Common
8					

Major ALARM

This alarm is a logical OR of all the major system fail alarms generated internally and listed in section 5.1.

If the Major Alarm is asserted it means at least one of these alarms has been triggered. The cause of the Major flag can be found by interrogating the serial ports or the front panel display.

Minor ALARM

This alarm is a logical OR of all the minor system alarms generated internally to the unit (see Alarm Indication in section 5.1).

If the Minor Alarm is asserted, it means at least one of these alarms has been triggered. Interrogating either the serial outputs or front panel display will identify which alarm has caused the warning.

ISOLATED INPUTS

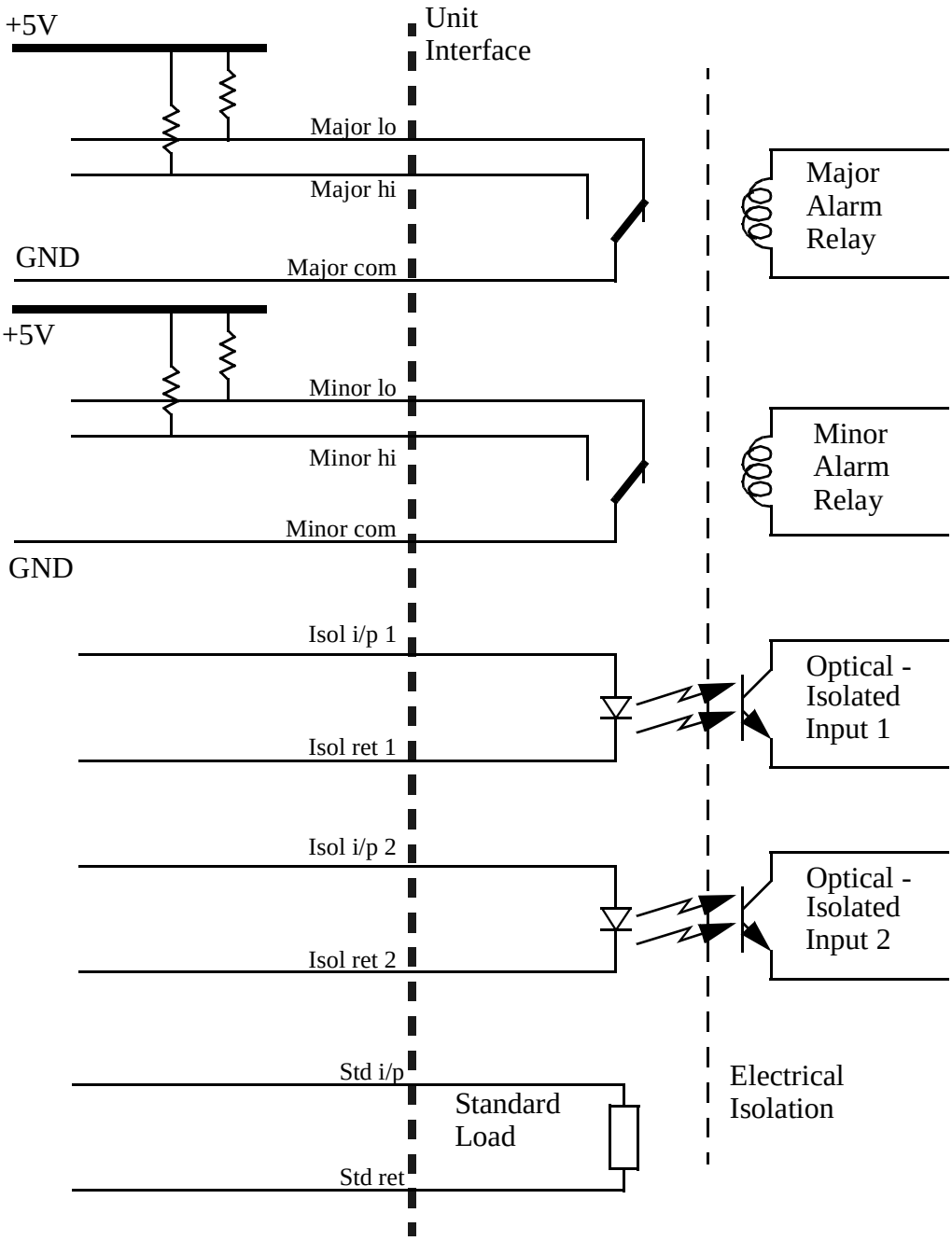
Two isolated inputs are provided. The first is configured to disable the optical output, the second to turn down the output to an eye safe level (<+7dBm).

STANDARD LOAD

The standard load is a simple connection internal to the subrack. By monitoring the impedance across this line, an operator can be confident that connection to the alarm outputs socket has been maintained and the lead has not been cut or removed.

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Figure 7 : Block Diagram of Alarm Outputs Interface



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5.3.4 Power Supply

The Type-119 subrack can be supplied as either an AC mains powered unit or a 48V DC powered unit. This will determine which connection is available on the back plane.

MAINS - Standard IEC 3 pin mains connector with double fuse (live and neutral).

48V DC - Framatome 3 pin crimp 48V DC connector with double fuse (+ve and -ve).

6.0 MECHANICAL

Fig. 4 gives an outline drawing of the complete subrack with ETSI side mounting brackets. Mounting brackets for the 19” standard are also available. The outer dimensions for a unit with the fibre interlock on the rear are shown in Fig. 8 and summarised in the Table 11.

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Figure 8 : Overall Dimensions.

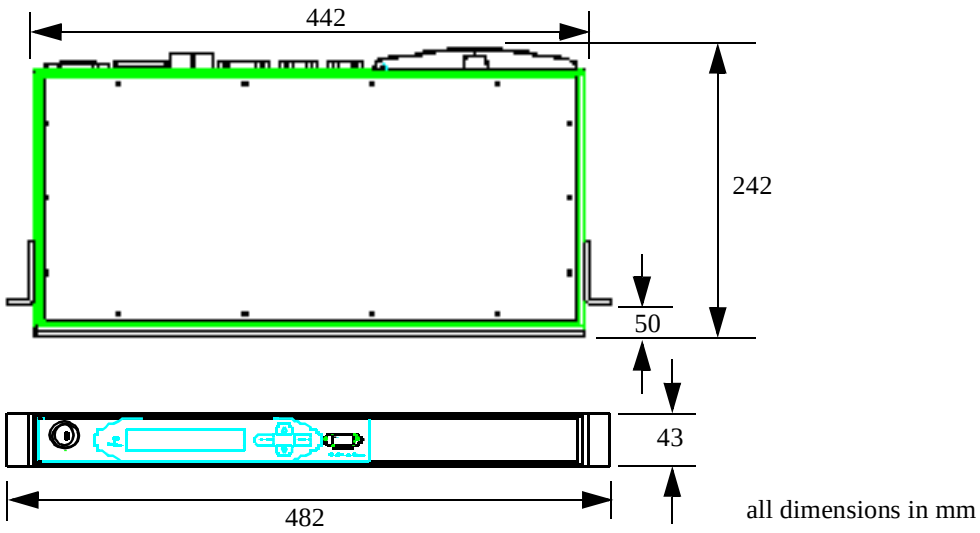


Table 11: Type-119 Subrack Dimensions in mm.

Parameter	Typ (note 2)	Std ETSI envelope	Std 19" envelope
Subrack Depth (note 1)	242	280	300
Subrack Width	442	445	450
Subrack Height	43	50 (2SU)	44.45 (1U)
Overall Width (including mounting brackets)		535	482.6
Pitch of mounting holes		515	465
Bracket offset from front panel		45	0

Notes:

1. This dimension includes the electrical and optical connectors.
2. Typical dimensions of subrack. Manufacturing tolerance +/- 0.5mm.

6.1 Power Dissipation & Thermal Design.

The maximum case temperature is 50 ^{o}C, and the total power dissipation including the optics is less than 20 watts for 50 ^{o}C ambient temperature.

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7.0 APPENDICES

7.1 Appendix A: Front Panel Interface Specification.

Fig. 9 gives an overview of the menu structure used on the front panel display. A more detailed description of each menu is given in the sections that follow.

NOTE: To enter the Configuration menu the password required is to simultaneously press the Up arrow and Down arrow keys. The Reset key exits from the current menu back to the Default Display, while selecting RETURN from any menu takes you up one level to the feed menu.

7.1.1 Default display.

By default the display shows the input and output power on the top line with a status indication and "ENTER for menu" on the bottom line. If an alarm is triggered - causing the status light of the unit to change - this is written on the bottom left of the display. If more than one alarm is triggered, a down arrow will signify that there are more alarms to view, and pressing the down arrow button will scroll through them.

An example of the display when the status is OK is shown below:

```
IN:-0.3dBm OUT:+16.1dBm
OK         ENTER for menu
```

The alarms are listed in the following order:

FIB OPEN	-	Fibre interlock cover open
PWR FAIL	-	Output power out of limits
LOS ON	-	Loss of input signal
Idrv HI	-	Laser drive current too high
Tlas ON	-	Laser submount temperature out of limits
Tint ON	-	Internal temperature of unit out of limits

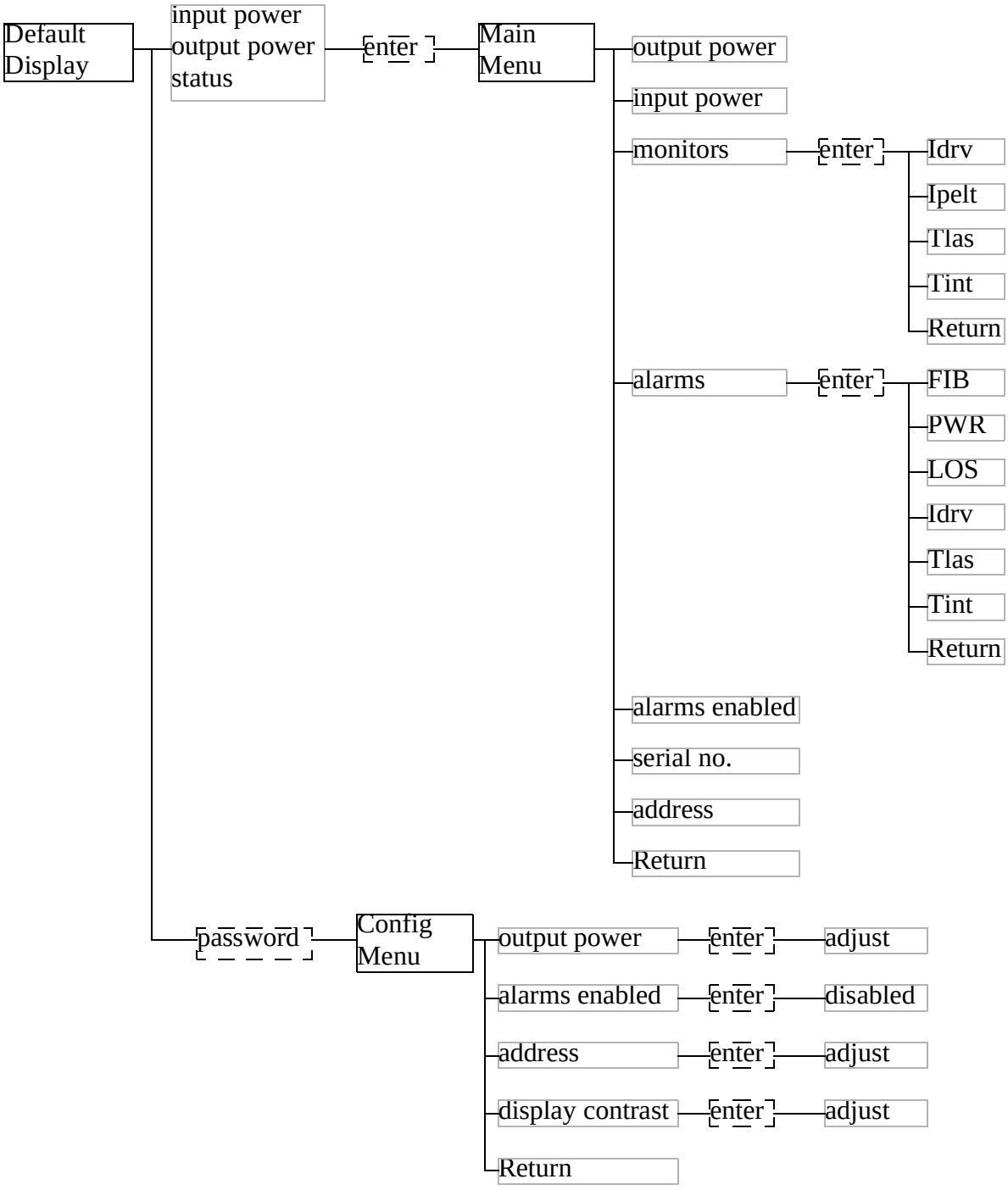
An example of the display when alarms are raised is shown below:

```
IN:-0.3dBm OUT:+16.1dBm
FIB OPEN↓ ENTER for menu
```

The default display is continually updated with status information. All the other displays in the sub-menus are only updated when they are first entered, to refresh the display, you must change the parameter that is displayed and then return to the chosen item.

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Figure 9 : Overview of Front Panel Command Menu Structure.



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7.1.2 Main Menu.

The top level menu gives an overview of the unit status and allows access to more detailed monitors. The menu items are accessed by scrolling up and down the list - with only one item shown on the display at any one time. If there are menu items below the one shown on the display, then a down arrow is visible in the bottom right hand corner. Similarly, if there are menu items above the one shown, an up arrow will be displayed alongside the down arrow.

The menu items are selected using the up and down arrow keys on the front panel. When the desired item is displayed, ENTER will move to the next level (if appropriate, see actions for each item below).

Menu items:

OUTPUT POWER: +16.1 dBm

INPUT POWER: +0.1 dBm

MONITORS:

ALARMS:

ALARMS: ENABLED

SERIAL NO: AM12345

ADDRESS: 1234

RETURN:

Below is an example display showing ALARMS and up and down arrows to show that there are menu items above and below those shown.

```
MAIN MENU
ALARMS:                  ↑↓
```

If no keys are pressed for approximately 5 minutes, the unit will automatically time-out of the main menu and return to the default screen.

Action for each menu item.

When a menu item is selected, pressing the ENTER key may give access to another level of menus. The result of selecting each menu item is outlined below.

OUTPUT POWER:

Displays the current output power of the unit. No action results from pressing ENTER.

INPUT POWER:

Displays the current input power to the unit. No action results from pressing ENTER.

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MONITORS:

Pressing ENTER gives access to another menu, displaying all the monitored parameters.

```
Idrv1: 100mA   2: 80mA
Tpelt1: 120mA 2: 140mA
Tlas1: 27 °C   2: 25 °C
Tint: 29 °C
RETURN:
```

These monitors can be scrolled through in the same way as the main menu. None of the monitors can be selected. Selecting RETURN: returns the user to the main menu, pressing RESET exits back to the default display.

ALARMS:

Pressing ENTER gives access to another menu, displaying each ALARM and its status.

```
FIB ALARM: OFF
PWR ALARM: OFF
LOS ALARM: OFF
Idrv ALARM: OFF
Tlas ALARM: OFF
Tint ALARM: OFF
RETURN:
```

These alarms can be scrolled through in the same way as the main menu. None of the alarms can be selected. Selecting RETURN: returns the user to the main menu, pressing RESET exits back to the default display.

ALARMS: ENABLED

States whether or not the alarms are currently activated. No action results from pressing ENTER.

SERIAL NUMBER:

The serial number of the unit, defined at manufacture and never changed. No action results from pressing ENTER.

ADDRESS:

The communication address of the unit. No action results from pressing ENTER.

RETURN:

Selecting and pressing ENTER moves the user back to the default screen. This can also be achieved by pressing RESET at any stage.

7.1.3 Configuration menu.

Entering the password at any stage will cause the display to go into the configuration menu, allowing the user to change a number of parameters. Access to the Configuration menu can be denied by

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setting the Front Panel Access Flag to OFF via the serial interface. Whenever the configuration menu is entered, the front panel status light will change to AMBER. The menu accessed is as below:

```
OUTPUT POWER: +16.1dBm
ALARMS: ENABLED
ADDRESS: 1234
DISPLAY CONTRAST:
RETURN:
```

If no keys are pressed for approximately 5 minutes, the unit will automatically time-out of the configuration menu and return to the default screen.

Action for each menu item.

OUTPUT POWER:

Allows the user to adjust the output power of the unit within pre-determined limits. Pressing ENTER changes the display as below. The blank rectangle is in fact a flashing character, signifying that the number is ready to change.

By pressing the up and down arrow keys, the output power can be varied within pre-determined limits. When the desired level is reached, pressing ENTER confirms the value and returns the user back to the configuration menu. Pressing RESET at any time, aborts any changes made and returns the user to the default display.

```
CONFIGURATION MENU
OUTPUT POWER: +15. dBm
```

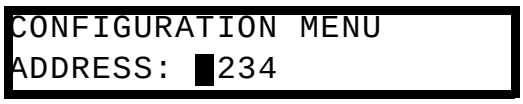
Changing the output power in this way causes the unit to run in constant output power mode, irrespective of any previous set-up.

ALARMS: ENABLED

This menu item can be toggled between ALARMS ENABLED and ALARMS DISABLED by pressing ENTER. ALARMS DISABLED means that any parameter out of limits does not trigger an alarm on the serial interface. The LCD, LED and relays still register the alarm and, if applicable, the amplifier is still disabled. The status light on the front panel will go to AMBER whenever the alarms are disabled.

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ADDRESS:

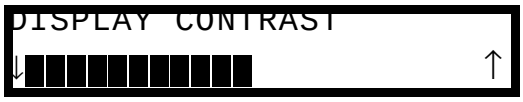


Selecting and pressing ENTER allows the user to change the unit address. Only one character of the 4 character address can be changed at once, the up and down arrow keys either increase or decrease the character by one between 0 and F. When the correct figure is reached, pressing ENTER moves the cursor to the next character to the right to repeat the process. The blank rectangle in the diagram will in reality flash to portray which character is being changed.

Pressing ENTER when all 4 characters are set confirms the new address and returns the user to the configuration menu. Pressing RESET at any stage aborts the changes and returns the user to the default display.

DISPLAY CONTRAST:

The display changes as below and allows the user to vary the display contrast. The up and down arrow keys will turns the contrast up and down, and the bar graph along the 2nd row of the display will give a pictorial view of the value being set.



When complete, pressing ENTER confirms the contrast value and returns the user to the configuration menu. RESET will abandon the changes and return to the default display.

RETURN:

Selecting and pressing ENTER moves the user back to the default screen. This can also be achieved by pressing RESET at any stage.

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7.2 Appendix B: Serial Comms Interface.

7.2.1 Hardware Parameters

Both the RS232 and RS485 serial ports are designed to work with the following hardware settings:

- Data Rate: 9600 baud
- Data Bits 8
- Stop Bits 1
- Parity none

When using the RS485 channel, it is vital that no hardware handshaking is used.

7.2.2 Communications Protocol

The following is a list of user commands for the Type-119 subrack and the replies received. All commands must be terminated by CR, LF. Before accepting commands the rack must be activated by sending the appropriate address command (see below). Once activated the address of the active unit will be displayed as a prompt, indicating the unit is ready to receive a command, e.g. “0001>” for unit address 0001. When a unit comes out of reset it will be inactive (i.e. it will not reply to any commands received) until it sees its own address command. When an address command pointing to a different address is seen the unit will again become inactive.

The following descriptions show the prompt before the instruction to be issued, this is what will be seen on the screen and need not be typed. Where characters following a command are shown in square brackets, this indicates a choice of the listed options available e.g. [1,2] indicates the command can be issued with 1 or 2 following. The square brackets [] are not to be entered. Any spaces shown in the syntax MUST be entered.

7.2.3 RS232 / RS485 Protocol

The Type-119 subrack is fitted with an RS485 interface on the rear panel and an RS232 interface on the front panel. In order to prevent any possible conflicts which may arise if both serial channels are operating simultaneously, the RS232 local interface on the front panel will always take precedence and commands received on the RS485 channel will be ignored whenever the RS232 interface is in use.

7.2.4 Front Panel Conflicts

Similarly, when the front panel enters configuration mode, all commands through the front panel take precedence over any serial comms, until such time as configuration mode is left - either hitting the key to return or timing out. During this period, the serial comms is still open for read access.

7.2.5 Password Protection

The password is a 4 hexadecimal digit PIN (e.g. 12AB). When the password is entered all commands are enabled in the normal way, enabling complete read and write access to all parameters.

When the password is not entered read only access is allowed and a response of??? will be returned if a write command is attempted.

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To enter the password use the AD (or ADQ) command in the normal way with the password following the address:

`AD 1 12AB` - Activates the unit with address 1 and password 12AB in read/write mode.

To clear password mode enter the AD (or ADQ) command without the password:

`AD 1` - Activates the unit with address 1 in read only mode.

When the unit is deactivated (a non-matching address seen) the password mode is cleared.

Only the following commands are protected by password and will cause a response of??? if protected commands are disabled. A more detailed explanation of all the commands is given in later sections.

- `AL [Y,N]` (enables or disables the alarms)
- `FP [Y,N]` (set front panel write access)
- `LO -10` (set unit LOS detection point)

Note. Some of the above commands can be issued, without values, to act as a read command. This usage will be unaffected by password status.

7.2.6 List of Commands.

Table 12 gives a summary of all the commands available on the serial comms channel of the Type-119 amplifier. Following is a more detailed listing of each command syntax along with replies and other applicable information.

For correct command syntax, the spaces shown MUST be included, or the unit will reply??? signifying an unrecognised command. Where square brackets are shown [], this denotes that only one of the items within the brackets is entered. The brackets must not be entered.

`0001> AD 2 [PASS]` - Instructs unit address 2 to become active, all other units will become inactive. Active unit will echo all characters received. Address is a hexadecimal number in the range 0 -FFFE. Address FFFF is used as a global address and all units seeing it will become active. If PASS is not entered (or entered incorrectly) read only access is granted. All commands requiring a write operation will be answered with???. PASS is a 4 digit hexadecimal number.

Reply is the prompt of `0002>`

`0001> ADQ 2 [PASS]` - As AD command but the active unit will NOT echo any characters received. All other parameters are the same as the AD command.

Reply is the prompt of `0002>`

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Table 12: Summary of commands for Type 119 Subrack

Command	Syntax	Description	Password Protected
AD	AD Addr [PASS]	Address command with optional password	
ADQ	ADQ Addr [PASS]	No echo address command with optional password	
AL	AL	Status of alarms - enabled or disabled	
	AL [Y,N]	Enable [Y] or disable [N] alarms	Y
AP	AP	Amplifier power	
AS	AS	Amplifier status	
CA	CA SerNo Addr	Change address of amplifier	
FP	FP	Status of front panel access flag	
	FP [Y,N]	Enables [Y] or disables [N] front panel access	Y
LO	LO	Set point for LOS alarm	
	LO Val	Sets threshold for LOS alarm (in dBm)	Y
LP	LP [1,2]	Laser power	
LS	LS [1,2]	Laser status	
LT	LT [1,2]	Laser temperature	
MB	MB	Mode of boost laser	
MC	MC	Mode of control laser	
V	V	Firmware version	

`0001> AL` - reply is of the form:

`ENABLED` or

`DISABLED` to signify whether alarm conditions will be highlighted (ENABLED) or not.

`0001> AL [Y,N]` - This command is password protected. Enables (AL[Y]) or disables (AL[N]) the alarms. When disabled, no alarms will be triggered irrespective of conditions within the unit. This command should obviously be used with care as it could mask some serious problems with the unit. The factory default condition is AL[Y]. Reply takes the form:

`OK` if successful and stored or:

`???` if it is not possible to set the required parameters or the unit is password protected and in read only mode.

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0001> AP - asks for the optical powers of the amplifier. Reply in the form:-

`I/P:-1.2dBm O/P:10dBm`

i.e., input optical power is -1.2dBm, output optical power is 10dBm.

0001> AS - asks for the status of the amplifier. Reply in the form:-

`STATUS:[OK DISABLED PWR LOS TINT FPA FIB]`

One or more of the messages in [] will be displayed. Below is a brief explanation of each status label.

- `OK` - Normal operating status
- `DISABLED` - Lasers are disabled
- `PWR` - Output power is out of limits (causes lasers to be disabled)
- `LOS` - Loss of input signal (causes lasers to be disabled)
- `TINT` - Internal temperature of unit out of limits (may cause lasers to be disabled)
- `FPA` - Access to the configuration menu through the front panel is permitted.
- `FIB` - Fibre interlock open (causes lasers to be disabled)

Note: Status will always read OK if the alarms have been disabled by the AL[N] command.

0001> CA SerNo Addr - instructs the unit with Serial Number SerNo to adopt communications address Addr. SerNo is specified during manufacture and written on the label on the rear of the unit, Addr is a hexadecimal number in the range 0 - FFFE. The factory default is an address of 0001. Reply takes the form:

`OK` if successful and stored or:

`???` if the command format was incorrect.

0001> FP - returns the current status of the Front Panel Access Flag:

`FP ON` if full read / write access granted.

`FP OFF` if read only access granted.

The factory default is FP ON for full read / write access, although to alter any parameters through the front panel, the user still needs to enter a password (see Front Panel Display section).

0001> FP [Y,N] - This command is password protected. Enables (FP[Y]) or disables (FP[N]) write access to the amplifier through the front panel display and keys. When write access is disabled (FP[N]) it is not possible to change the unit settings through the front panel, even if the front panel password is entered. Factory default is FP[Y] to allow front panel access. Reply is of the form:

`OK` if successful and stored or:

`???` if the command format was incorrect or the unit is password protected and in read only mode.

0001> LO - asks for the current LOS set point. The reply is in the form:

`-10dBm`

0001> LO -20 - This command is password protected. Sets the LOS point to be -20dBm. Factory default is a -10dBm set point. Reply is in the form:-

`OK` if successful and stored or:

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??? if the command format was incorrect or the unit is password protected and in read only mode.

0001> LP [1,2] - asks for the power of laser 1(2). Reply is in the form:

```
P1:123.4 mA, 12.3 mW
```

indicating laser1 drive current is 123.4mA and the rear facet power is 12.3mW.

0001> LS [1,2] - asks for the status of laser 1(2). Reply is in the form:

```
S1:[OK DISABLED TLAS IDRV PWR NOT FITTED]
```

One or more of the messages in [] will be displayed. The list below explains briefly the meaning of each status label.

- `OK` - Normal laser operation
- `DISABLED` - Laser is disabled
- `TLAS` - Laser temperature out of limits
- `IDRV` - Laser drive current out of limits
- `PWR` - Laser output power failure
- `NOT FITTED` - Laser is not fitted

Note: Status will always read OK if the alarms have been disabled by the AL[N] command.

0001> LT [1,2] - asks for the temperature of laser 1(2). Reply is in the form:

```
T1:22.3,123 mA
```

indicating laser1 Submount temperature is 22.3degC and the TEC drive current is 123mA.

0001> MB - asks for the Mode of the boost laser. Reply is in the form:

```
BOOST:L2, Mode:D, Req:123.4mA
```

indicating Laser 2 is the boost laser, running in constant Drive mode with a power requirement of 123.4mA. Possible modes are D (constant forward drive current), M (constant rear facet monitor) and S (soft fail mode).

0001> MC - asks for the Mode of the control laser. Reply is in the form:

```
CONTROL:L1, Mode:O, Req:12dBm
```

indicating Laser 1 is the control laser, running in constant Output power mode with a power requirement of 12dBm. Possible modes are D (constant forward drive current), M (constant rear facet monitor), O (constant output power) and S (soft fail mode).

0001> V - asks for the version of 68HC11 software currently loaded in program EEPROM and the version of downloader in EPROM. The reply is in the form:

```
Download V1.0 16-Jul-97
Type 119 V1.0 25-Aug-97
Serial No: AM65432
Gain Block No: FA17U-95 AM12345
```


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7.3 Appendix C: Maintenance

No periodic servicing of the unit is required. No internal user adjustments or calibration can be made.

Nortel recommends that electrical safety checking and the correct operation of the fibre interlock be periodically tested to ensure correct operation in accordance with the customer's safety procedures. The interlock is designed to remove the laser's power when the door is opened by more than 1cm.

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