Smart choice for power

xantrex

XMP 2600

User's Guide

Xantrex Multiple Output Power System XMP 2600

www.xantrex.com

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User's Guide

Rev. 1.0 8/2003

Limited Warranty

What does this warranty cover and how long does it last?

This Limited Warranty is provided by Xantrex Technology, Inc. ("Xantrex") and covers defects in workmanship and materials in your XMP 2600 Power Supply. This warranty lasts for a Warranty Period of 3 years from the date of purchase at point of sale to you, the original end user customer.

What will Xantrex do?

Xantrex will, at its option, repair or replace the defective product free of charge, provided that you notify Xantrex of the product defect within the Warranty Period, and provided that Xantrex through inspection establishes the existence of such a defect and that it is covered by this Limited Warranty.

Xantrex will, at its option, use new and/or reconditioned parts in performing warranty repair and building replacement products. Xantrex reserves the right to use parts or products of original or improved design in the repair or replacement. If Xantrex repairs or replaces a product, its warranty continues for the remaining portion of the original Warranty Period or 90 days from the date of the return shipment to the customer, whichever is greater. All replaced products and all parts removed from repaired products become the property of Xantrex.

Xantrex covers both parts and labor necessary to repair the product, and return shipment to the customer via a Xantrex-selected non-expedited surface freight within the contiguous United States and Canada. Alaska and Hawaii are excluded. Contact Xantrex Customer Service for details on freight policy for return shipments outside of the contiguous United States and Canada.

How do you get service?

If your product requires troubleshooting or warranty service, contact your merchant. If you are unable to contact your merchant, or the merchant is unable to provide service, contact Xantrex directly at:

Phone:	604 422 2777
Toll Free North America:	1 800 670 0707
Fax:	604 420 2145
Email:	customerservice@xantrex.com

Direct returns may be performed according to the Xantrex Return Material Authorization Policy. For some products, Xantrex maintains a network of regional Authorized Service Centers. Call Xantrex or check our website to see if your product can be repaired at one of these facilities.

In any warranty claim, dated proof of purchase must accompany the product and the product must not have been disassembled or modified without prior written authorization by Xantrex.

Proof of purchase may be in any one of the following forms:

- The dated purchase receipt from the original purchase of the product at point of sale to the end user, or
- The dated dealer invoice or purchase receipt showing original equipment manufacturer (OEM) status, or
- The dated invoice or purchase receipt showing the product exchanged under warranty

What does this warranty not cover?

This Limited Warranty does not cover normal wear and tear of the product or costs related to the removal, installation, or troubleshooting of the customer's electrical systems. This warranty does not apply to and Xantrex will not be responsible for any defect in or damage to:

a. the product if it has been misused, neglected, improperly installed, physically damaged or altered, either internally or externally, or damaged from improper use or use in an unsuitable environment;

b. the product if it has been subjected to fire, water, generalized corrosion, biological infestations, and high input voltage from lightning strikes;

c. the product if repairs have been done to it other than by Xantrex or its authorized service centers (hereafter "ASCs");

d. the product if it is used as a component part of a product expressly warranted by another manufacturer;

e. the product if its original identification (trade-mark, serial number) markings have been defaced, altered, or removed.

Disclaimer Product

THIS LIMITED WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY PROVIDED BY XANTREX IN CONNECTION WITH YOUR XANTREX PRODUCT AND IS, WHERE PERMITTED BY LAW, IN LIEU OF ALL OTHER WARRANTIES, CONDITIONS, GUARANTEES, REPRESENTATIONS, OBLIGATIONS AND LIABILITIES, EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE IN CONNECTION WITH THE PRODUCT, HOWEVER ARISING (WHETHER BY CONTRACT, TORT, NEGLIGENCE, PRINCIPLES OF MANUFACTURER'S LIABILITY, OPERATION OF LAW, CONDUCT, STATEMENT OR OTHERWISE), INCLUDING WITHOUT RESTRICTION ANY IMPLIED WARRANTY OR CONDITION OF QUALITY, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE TO THE EXTENT REQUIRED UNDER APPLICABLE LAW TO APPLY TO THE PRODUCT SHALL BE LIMITED IN DURATION TO THE PERIOD STIPULATED UNDER THIS LIMITED WARRANTY.

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Exclusions

If this product is a consumer product, federal law does not allow an exclusion of implied warranties. To the extent you are entitled to implied warranties under federal law, to the extent permitted by applicable law they are limited to the duration of this Limited Warranty. Some states and provinces do not allow limitations or exclusions on implied warranties or on the duration of an implied warranty or on the limitation or exclusion of incidental or consequential damages, so the above limitation(s) or exclusion(s) may not apply to you. This Limited Warranty gives you specific legal rights. You may have other rights which may vary from state to state or province to province.

Information

WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, UNLESS SPECIFICALLY AGREED TO BY IT IN WRITING, XANTREX

a. MAKES NO WARRANTY AS TO THE ACCURACY, SUFFICIENCY OR SUITABILITY OF ANY TECHNICAL OR OTHER INFORMATION PROVIDED IN MANUALS OR OTHER DOCUMENTATION PROVIDED BY IT IN CONNECTION WITH THE PRODUCT; AND

b. ASSUMES NO RESPONSIBILITY OR LIABILITY FOR LOSSES, DAMAGES, COSTS OR EXPENSES, WHETHER SPECIAL, DIRECT, INDIRECT, CONSEQUENTIAL OR INCIDENTAL, WHICH MIGHT ARISE OUT OF THE USE OF SUCH INFORMATION.

THE USE OF ANY SUCH INFORMATION WILL BE ENTIRELY AT THE USER'S RISK.

WARNING: Limitations on Use

Please refer to your product manuals for limitations on uses of the product. Specifically, please note that this power supply is not intended for use in connection with life support systems and Xantrex makes no warranty or representation in connection with any use of the product for such purposes.

Xantrex Technology, Inc.

8999 Nelson Way

Burnaby, British Columbia

Canada V5A 4B5

Information About Your Power Supply

Please record the following information when you first open your Power Supply package:

Model Number _____

Serial Number _____

Purchased From _____

Purchase Date _____

Release

Release 1.0 (2003-08)

Safety Summary

IMPORTANT

Read this safety summary before operating the unit.

The following safety precautions are to be kept and observed by the user. Noncompliance with these safety rules may cause hazard and is exclusively under the user's responsibility.

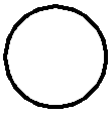
Power Supply Grounding

The XMP 2600 must be connected to an earth terminal. The unit comes with a three wires power cord. The Yellow/Green wire must be connected to the earth terminal in the electrical power outlet.

Disconnection of the earth wire might result in personal shock hazard.

Description Of Power Supply Symbols

The following table provides descriptions for the symbols that appear on the XMP 2600:

Symbol	Description
	Protective conductor terminal
	On
	Off
	Caution, risk of electric shock
	Warning (refer to accompanying documents)

Input Mains Voltage Rating

The XMP 2600 operates at the following mains nominal voltages:

- 170Vac - 265Vac nominal (45 to 66Hz)
- 120Vac nominal, up to 1KW output power (45 to 66Hz)

Do not exceed this voltage range (nominal), as deterioration of performance or damage to the unit is likely to occur. The following table shows the mains voltage specification of the Power Supply (for more detailed information please refer to the Operating Conditions section of chapter 1):

Nominal Mains	Nominal Current
230Vac	Iin<15A
120Vac, Po<1KW	Iin<15A

Mains supply voltage fluctuations may not exceed +/-10% of the nominal voltage.

Power plug shall be fitted according to each national electrical code, and rated for a current of at least 20A.

WARNING

The XMP 2600 must be operated at the proper mains voltage. Before operating the unit make sure the mains voltage complies with the range described above. Noncompliance with the input voltage may cause hazard and damage to the unit!

Do Not Open The Unit

The user, except when replacing modules, should not open the unit.

WARNING

Make sure the power cord is disconnected from the mains before opening the unit. High voltages inside the unit may cause electric shock.

Air Inlets And Air Outlet

The Power Supply is a forced air-cooled unit. Cooling is essential for the unit's proper operation.

The unit includes four air inlet openings located in the front panel, in both the left and right sides near the front panel and in the top cover near the front panel. The air outlet is in the rear panel (all over its surface).

Make sure there are no obstructions for the airflow, at least two centimeters (0.8”) away from these openings.

Obstructing these ventilation openings may cause fire and irreversible damage to the unit.

Output Voltages

The Power Supply's outputs (at the unit's rear) may carry high voltages. Make sure to handle them properly to avoid shock hazard.

Unused outputs must be closed with load connectors (these connectors must include sense lines connections).

Nonoperative Modules

Do not operate the unit if it contains damaged or defective modules. Hazard or damage may occur.

Damaged or defective units should be repaired by authorized personnel only.

WARNING

Do not operate the unit with a missing module. Modules must be arranged consecutively from left to right. Unused module locations must be closed with ventilation obstructions. Operating the unit with missing modules or missing internal ventilation obstructions may cause overheating and fire hazard.

Power Supply Safety

WARNING — High Energy and High Voltage

Exercise caution when using and calibrating a power supply. High energy levels can be stored at the output voltage terminals on a power supply in normal operation. In addition, potentially lethal voltages exist in the power circuit and on the output and sense connectors of a power supply with a rated output greater than 40 V. Filter capacitors store potentially dangerous energy for some time after power is removed.

CAUTION

Operate the power supply in an environment free of flammable gases or fumes. To ensure that the power supply's safety features are not compromised, use the power supply as specified in this manual and do not substitute parts or make any unauthorized modifications. Contact the service technician for service and repair help. Repairs must be made by experienced service technicians only

Regulatory Approvals and Safety Agency Compliance

Regulatory Approvals

European Standards:	Electromagnetic Emissions and Immunity -meets Council Directive 89/336/EEC
Electromagnetic Emissions:	EN61326:1997 +A1:1998
	EN61000-3-2:2000
	EN61000-3-3:1995
Electromagnetic Immunity:	EC61326:1997 +A1:1998

Safety Agency Compliance

European Standards:	
Safety	Meets EN61010 –1
American Standards:	
Electromagnetic Emissions	Meets FCC Class A
Safety	Meets UL61010-1

About this manual

This User's Guide contains information on operating the XMP 2600.

Who should use this manual

This manual is designed for users who understand basic electrical theory, especially as applied to the operation of power supplies. This implies a recognition of constant voltage and constant current operating modes and the control of input and output power, as well as the observance of safe techniques while making connections to the supply and any changes in settings.

Chapters

Chapter 1: General Information gives basic information on using and operating the XMP power supply.

Chapter 2: Installation describes the proper way to install the XMP. It also describes the XMP's connections to external devices and the load and details the way to install / replace a power module.

Chapter 3: Turn-On Checkout describes the way to configure and test the XMP 2600 power supply system and its power modules.

Chapter 4: Using the Front Panel describes the front panel with its display, keys and indicators. It provides detailed description on how to operate the XMP 2600 using its front panel with an emphasis on viewing status information.

Chapter 5: First Operation Steps guides you through the first steps of manually programming the XMP 2600 power supply system.

Chapter 6: Basic Operation provides basic operating instructions when manually programming the XMP 2600 power supply system.

Chapter 7: Advanced Features covers advanced features offered by the XMP 2600 power system and explains the way to utilize them while operating the power supply from its front panel.

Chapter 8: Sequence Programming describes the way to utilize Sequence programming which is a feature of the XMP 2600 that enables it to automatically change states and create dynamic outputs without the use of a remote controller.

Chapter 9: Power Supply Setup describes how to control system and communication links parameters, some power module parameters, view system's controller and power module's controller information, and other setup issues.

Appendix A: System Messages contains a list of all the messages that may be displayed by the XMP's main controller during operation.

Appendix B: Error Codes describes the XMP's main controller and power modules generated error codes that may be displayed during operation.

Appendix C: Test Results describes the way power module test results can be interpreted.

Appendix D: Calibration discuses calibration issues.

Terminology

The following explains the jargon unique to the XMP 2600 as used in this programming manual:

Slot ..... a physical location within the XMP's mainframe where power modules are installed. Each power module occupies 1, 2 or 3 slots depending on its voltage and current ratings.

Channel ..... a logical location on the internal communications link (connecting power modules to the XMP's main controller). Each location is identified by an address in the range 1 to 16.

Module's address ..... the number of the channel the power module is associated with. The power module address is used to identify the power module in programmed commands and other operations.

net ..... a communications link connecting power modules to the XMP's main controller. The net comes in two flavors: internal net – running inside the mainframe and external net – interconnecting mainframes.

Table of contents

Appendices

1 General Information

This user's guide describes the installation, checkout and stand-alone operation of the XMP 2600 power supply system.

Operating Conditions

The unit is intended for indoor use, at the following environmental operating conditions:

- Altitude: up to 2,000m
- Temperature: 0ºC to 55ºC (display up to 50ºC). Derate output power by 1% per ºC from 30ºC to 55ºC.
- Maximum relative humidity 80% for temperatures up to 30°C decreasing linearly to 40% relative humidity at 55°C.
- The product shall be installed as Category II (Overvoltage Category) and in Pollution Degree II Environmental.
- The unit operates at the following mains ranges:

Nominal Mains	Nominal Current
230Vac	Iin<15A
120Vac, Po<1KW	Iin<15A

Before operating the unit make sure the mains voltage source and the electrical plug comply with the unit's specified voltage and current ranges.

Instrument Contents And Options

The instrument consists of the mainframe, power modules and optionally control modules for external hardware control.

The mainframe includes:

Option 0:..... Full front panel with keyboard, display, line switch and line indicator.

Option 2:..... Slave expansion mainframe, which can be connected only to a second unit, option 0. Blank front panel, which has only line switch and line indicator.

The power modules installed are according to the user's order. Up to eight (1/8 width) power modules can be installed.

Power module's internal output relays are standard and may, optionally, be omitted at the user's request. They enable output disconnection and polarity reversal.

Cleaning

The instrument may be cleaned using a dry soft cloth.

WARNING

No liquid of any kind may be used for cleaning the instrument.

Accessories

The unit comes with the following standard accessories:

1) One CD-ROM with:
   User's Guide
   Programming Manual
   Soft Panel and Demonstration Software
   Software drivers
   Tutorial presentation
2) One printed User's Guide (this guide).
3) One printed programming Manual.
4) One printed quick reference guide.
5) One printed function keys reference card.
6) Four screws for replacing the unit's legs, if desired.
7) One male load connector per power module, including pins and back-shell.
8) One On-Off control connector.
9) One diagram with the installed modules location and modules' addresses.
10) One warranty document.

In addition, the following accessories can be ordered:

1) User's guide (P.N.: TM-XMUG)
2) Programming manual (P.N.: TM-XMPM)
3) Output load connector (P.N.: XMP LCON) (including back shell and pins)
4) Extension 1.2 meter *net* cable for connecting slave expansion mainframe (P.N.: XMP NET CBL)
5) GPIB cable, 1 meter (P.N.: XMP GPIB CBL)

6) Sliding rails kit for rack mounting (P.N.: XMP RM)

Mainframe Power Envelope

The XMP 2600 allows for the combination of high and low power modules in the same mainframe. Modules can be installed in the physical space available regardless of their power rating. However, the overall power drawn from the mainframe at one time is limited to 2.4 KW continuous, and about 2.6 KW intermittent. The main controller continuously monitors the overall power drawn from the mainframe. It will automatically alert the host in case of a brief violation - overall power between 2,400W and 2,600W for up to 30 seconds, and will automatically shut down the system in case of severe violation - overall power between 2,400W and 2,600W for more than 30 seconds, or above 2,600W.

Output Characteristics

The power modules have only current sourcing capability (no current sinking, except for voltage down-programming transients - for faster response).

WARNING

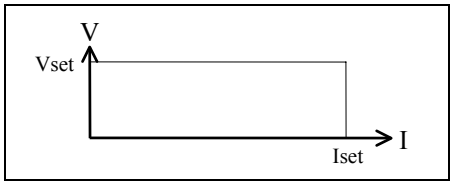
The power modules should not be fed with an external voltage source.

In applications in which an external voltage source might be applied (such as battery charging), an external series diode must be used in order to avoid current sinking by the power modules. In such case, sense lines must be connected to the module's output before the external series diode.

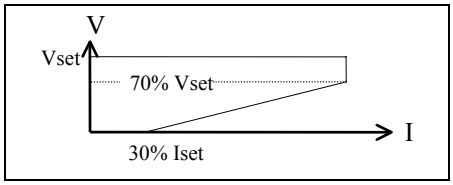
The power modules supply a constant voltage, till the load reaches the current limiting value. The modules can operate in one of five different current limitation modes. The current limitation mode can be separately selected for each module (using either the front panel or a remote controller).

The five different current limitation modes are:

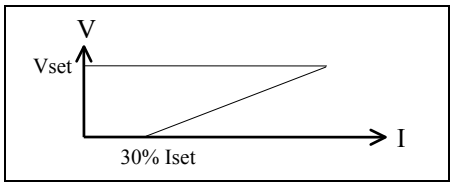
1) Constant voltage with current limited to the Iset value, or constant current with the voltage limited to the Vset value. The actual working point along the V-I range depends on the load characteristics.



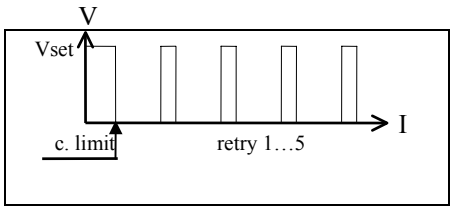
2) Constant voltage with current limit and Foldback when current demand increases, protecting the load from high short circuit currents.



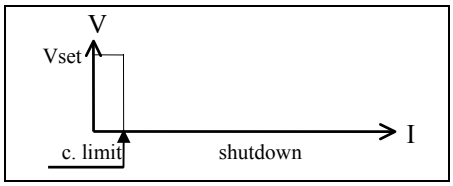
3) Foldback to 30% of the current limit for low short-circuit current.



4) Retry: when current limit is reached, the corresponding output is shut down for three seconds, and then restored again. After five consecutive current limit events, the corresponding output is shut down.



5) Single event shut down for extra-sensitive loads: when the current limit value is reached, the corresponding output is shut down.



Hardware Inputs/Outputs

The XMP 2600 includes several hardware inputs and outputs (all of them at the rear panel of the instrument), as the following describe:

1) Mains input: a non-detachable cord supplying power to the unit.
2) Power module's outputs: each power module has it's own output connector. The load connectors are supplied with the unit (one or two per module).
3) GPIB (IEEE-488) interface: programming and read back capability. Address can be set via dipswitch at the rear panel.
4) RS-232 interface: programming and read back capability, as well as monitor concise information output.
5) *net* interface: the internal communication link is available at the rear of the instrument to allow for daisy chaining slave expansion units.
6) Trigger in: this input allows for a hardware trigger to initiate a modules' response to an external event.
7) Sync. out: this output allows for hardware triggering of external devices synchronizing them to the unit's operations.
8) On-off control: allows the user to enable (or shut down), via hardware, the operation of the mainframe. In the same connector, a dry contact offers information regarding the system's operation ("on" or "off / disabled").

2 Installation

Inspection

When you receive the instrument, inspect it for any damage that may have occurred during shipment. In case of damage, notify immediately your carrier and our local representative.

Items Supplied

Check that the following items are supplied with the unit:

1) One CD-ROM (with: User's Guide, Programming Manual, Soft Panel and Demonstration Software, Software drivers, Tutorial presentation)
2) One printed User's Guide (this guide).
3) One printed Programming Manual.
4) One printed quick reference guide.
5) One printed function keys reference card.
6) Four screws for replacing the unit's legs (i.e. for "L" shaped rail mounting).
7) One male load connector per power module, including pins and back-shell.
8) One On-Off control connector.
9) One diagram with the modules' location and modules' addresses.
10) One warranty document.

WARNING

The XMP 2600 must be operated at the proper mains voltage, as specified in page ii under the title "Input Mains Voltage Rating". Before operating the unit make sure the mains voltage complies with the unit's specified voltage range.

Noncompliance with the input voltage may cause fire hazard and damage to the unit!

Location, Mounting And Ventilation

Use the XMP 2600 power supply in rack-mounted applications only. The XMP 2600 is designed to fit into standard 19" racks.

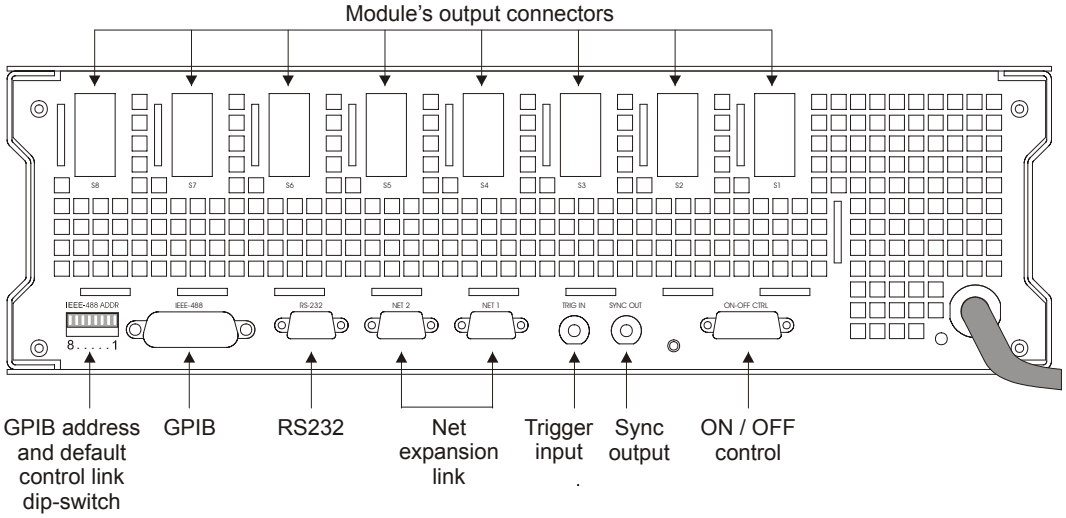
Install the XMP 2600 using only rack-mounted telescopic sliding rails, or rack-mounted slide brackets. Note that the front panel is not designed to hold the unit's weight.

Fasten the unit to the rack using bolts on both sides of the unit's front panel.

Keep an unrestricted air space of at least 5cm (2") at the rear so the exhausted hot air can flow freely.

Rear Panel Description

The rear panel contains all the connectors available to the user. It, also, serves as the ventilation exhaust of the unit.



GPIB Address and default control link

The GPIB (IEEE-488) address and the default control link can be changed from the rear panel using the switches labeled "IEEE-488 ADDR". They can also be changed using the front panel but that change will be temporary.

Switch number	function
8 (left most)	Should always be UP.
7	Enable the GPIB link for remote control when UP.
6	Enable the RS232 link when UP. If the GPIB link is enabled then the RS232 link will be in Monitor mode at Power On. If the GPIB link is disabled then the RS232 link will be in Control mode at Power On.
5 to 1	GPIB address (see table below).

> Changes in switch position are recognized when the XMP 2600 is turned on or undergoes full reset.

The GPIB address is set as illustrated below:

address	sw 5	sw 4	sw 3	sw 2	sw 1	address	sw 5	sw 4	sw 3	sw 2	sw 1
1	⇩	⇩	⇩	⇩	⬆	16	⬆	⇩	⇩	⇩	⬆
2	⇩	⇩	⇩	⬆	⇩	17	⬆	⇩	⇩	⬆	⇩
3	⇩	⇩	⇩	⬆	⬆	18	⬆	⇩	⇩	⬆	⬆
4	⇩	⇩	⬆	⇩	⇩	19	⬆	⇩	⬆	⇩	⇩
5	⇩	⇩	⬆	⇩	⬆	20	⬆	⇩	⬆	⇩	⬆
6	⇩	⇩	⬆	⬆	⇩	21	⬆	⇩	⬆	⬆	⇩
7	⇩	⇩	⬆	⬆	⬆	22	⬆	⇩	⬆	⬆	⬆
8	⇩	⬆	⇩	⇩	⇩	23	⬆	⬆	⇩	⇩	⇩
9	⇩	⬆	⇩	⇩	⬆	24	⬆	⬆	⇩	⇩	⬆
10	⇩	⬆	⇩	⬆	⇩	25	⬆	⬆	⇩	⬆	⇩
11	⇩	⬆	⇩	⬆	⬆	26	⬆	⬆	⇩	⬆	⬆
12	⇩	⬆	⬆	⇩	⇩	27	⬆	⬆	⬆	⇩	⇩
13	⇩	⬆	⬆	⇩	⬆	28	⬆	⬆	⬆	⇩	⬆
14	⇩	⬆	⬆	⬆	⇩	29	⬆	⬆	⬆	⬆	⇩
15	⇩	⬆	⬆	⬆	⬆	30	⬆	⬆	⬆	⬆	⬆

GPIB (IEEE-488) Connector

The GPIB connector is labeled "IEEE-488". It is a standard IEEE-488 connector, comprising a standard IEEE-488 interface.

Use good quality GPIB cables to ensure uninterrupted communications with the XMP 2600.

RS-232 Connector

The RS-232 connector is labeled "RS-232". It complies with the RS-232 communications standard. The RS-232 interface is configured in DTE mode. The connection to the host computer can be made using a pin-to-pin cable.

The connector's pin out is as follows:

Pin #	Signal
1	DTR
2	TX
3	RX
4	Not Connected
5	GND
6	DTR
7	CTS
8	RTS
9	Not Connected

> The RS232 communication link always uses hardware handshake (CTS and RTS signals). If you do not want to use hardware handshake, short pins 7 and 8.

net Connectors

The *net* is a proprietary internal communication link used to connect between the modules' controllers and the mainframe main controller. It is available at the rear enabling linking of expansion units (containing only modules), via the main mainframe, with the remote controller (IEEE-488 and RS-232 interface) by daisy chaining. There are two *net* connectors labeled "NET 1" and "NET 2" at the rear panel.

These connectors should be left open (unused) by the user if there are no modules external to the mainframe.

To link expansion mainframe with external modules just connect a pin-to-pin cable (such as TST 0330) from "NET2" in the controller to "NET1" in the expansion #1 unit. Additional units can be daisy-chained by connecting additional cables from NET2 in the expansion #1 unit to the NET1 connector in the expansion #2 unit, etc.

Trig. In Connector

The Trig. In connector is a BNC type connector, labeled "TRIG. IN".

It is used to trigger the modules' response to external events via hardware.

The Trig-In signal should be a TTL level signal (or open collector), able to sink 2mA to a "logic 0" level of 0.4V or less.

The modules' reaction to this signal is on the negative edge ("1" to "0" transition).

Sync. Out Connector

The Sync. Out connector is a BNC type connector, labeled "SYNC. OUT".

It carries the Sync. Out signal, available to the user for synchronizing external devices to the XMP 2600.

At a user selectable event, the XMP 2600 pulls the SYNC. OUT signal low for a period of about 250-500 microseconds. This output is a standard TTL level output with a 220 OHM series resistor. High impedance load is recommended for this signal (Such as CMOS devices with a pull-up resistor rated 10KOHM or higher or without a pull-up resistor).

On-Off Connector

This connector offers the user the option of shutting down (or enabling the operation of) the mainframe' power modules. It is a 15-pin D-TYPE female connector labeled "ON-OFF CTRL". It, also, offers a dry contact output (both N.O. and N.C.) for modules' operation indication.

The user can choose to control the unit by applying a 4VDC to 12VDC voltage (Rin = 220 OHM) to inhibit (or enable) operation of the modules, or, alternatively control the unit by applying a short to inhibit (or enable) operation of the modules.

> The unit will operate normally if the male connector is not present (ON by default).

The connector (15 pin D-Type male) wiring for the four options is as follow:

option 1

Vin=0V	⇨ modules operation enabled
Vin=4VDC to 12VDC	⇨ modules operation inhibited

Connect as follows:

+Vin	@ pin 3
-Vin	@ pin 11

> the +Vin and -Vin terminals are isolated and can be floated up to ±200VDC relative to the earth potential.

option 2

Vin=0V ⇨ modules operation inhibited

Vin=4VDC to 12VDC ⇨ modules operation enabled

Connect as follows:

+Vin @ pin 3

-Vin @ pin 11

Short pins #5 and #13.

> ↳ the +Vin and -Vin terminals are isolated and can be floated up to ±200VDC relative to the earth potential.

option 3

+/-SHORT shorted ⇨ modules operation enabled

+/-SHORT open ⇨ modules operation inhibited

Connect as follows:

+SHORT @ pin 2

-SHORT @ pin 11

Short pins #1 and #9.

Short pins #4 and #12.

> ↳ the -SHORT pin is the GND of the RS-232 and the IEEE-488.

option 4

+/-SHORT shorted ⇨ modules operation inhibited

+/-SHORT open ⇨ modules operation enabled

Connect as follows:

+SHORT @ pin 2

-SHORT @ pin 11

Short pins #1 and #9.

Short pins #4 and #12.

Short pins #5 and #13.

> ↳ the -SHORT pin is the GND of the RS-232 and the IEEE-488.

The dry contact outputs are as follow:

Pin #7 shorted to pin #6 when the modules are operating.

Pin #7 shorted to pin #14 when the modules are not operating.

These output indications are floating, isolated to 200VDC from earth ground.

Power Module's Output Connector

Each power module has it's own connector, accessible from the rear of the unit. Below each connector, a marking of the module's voltage and current rating can be seen. The connector carries two positive and two negative output pins and two sense lines.

The load male connectors are supplied with the unit, and are to be wired by the user. Wiring instructions can be found under the following "Load Connection" paragraph.

Load Connection

The loads are connected to the power modules through wires connected to the supplied load connector. The user must decide upon the wires to be used, and the connection point of the sense lines.

Wire Size

The wires size depends on the load current to be carried.

The recommended wire sizes are as follow:

Load current	AWG (mm^2)	Resistance/m
0A < I < 5A	1 x AWG18 (1.0mm^2)	21.7 mOHM/m
5A < I < 10A	1 x AWG16 (1.5mm^2)	13.7 mOHM/m
10A< I < 20A	1 x AWG14 (2.5mm^2)	8.6 mOHM/m
20A< I < 40A	2 x AWG14 (2.5mm^2)	½ x 8.6 mOHM/m

The necessary pins are supplied with the connectors. They fit to AWG 14 wire for crimping. The wires can be soldered as well, but special care must be taken to avoid tin spreading over the external part of the pin (which may prevent the pin's insertion in the connector's receptacle).

For the sense lines, AWG 22, or thicker, wires can be used.

The modules' outputs are isolated from ground, and can be floated up to ±240VDC. This voltage must not be exceeded, since damage may be caused to the modules.

The fact that the outputs are isolated from ground, enables the user to connect modules to provide positive and negative voltages, connect outputs in series, etc.

Local vs. Remote Voltage Sensing

The +/-SENSE lines have two roles in the power modules: they serve as feedback for output voltage regulation, and for load voltage measurement. The modules set the output voltage to meet the programmed voltage at the +/- SENSE lines connection point.

- The measured load voltage (VLOAD) is the voltage at the +/- SENSE lines.
- The measured output voltage (VOUT) is the internal voltage at the module's output, before the output connector.

There are two ways to connect the "+/-SENSE" terminals (available at the output load connectors): either local sensing or remote sensing.

In **local voltage sensing** connection, the +/-SENSE lines are shorted to the respective +/-VOUT lines near the output load connector (Usually within the

connector's plastic backshell). This way, the output voltage is as programmed near the module's output connector. Voltage drop may occur along the load lines due to the load current and the cables resistance.

Local sensing connection is a convenient practice when using low load currents or when the load regulation is not critical.

In **remote voltage sensing** connection, the +/-SENSE lines are connected to the respective +/-VOUT lines near the load connections. This way, the output voltage is as programmed near the load. The modules compensate for the load lines voltage drop (up to 2V drop over the two lines together).

Remote sensing connection is a convenient practice when using high load currents or when the load regulation is critical.

WARNING

Be careful to avoid +/-SENSE lines inverted connection. Inverted connection may damage the corresponding module.

- Open +/-SENSE lines will result in accuracy detriment of the output voltage. Output voltage might be somewhat higher than programmed!

- It is recommended to use twisted pair wires for the +/-SENSE lines, and to rout them closely in parallel to the +/-VOUT lines. In noisy environments, it might be necessary to use twisted shielded wires for the +/-SENSE lines. In this case, connect the shield to the -VOUT line near the module's output connector, and leave the other shield side open (Do not use the shield as the - VOUT or - VSENSE wire).

Dual output connector modules

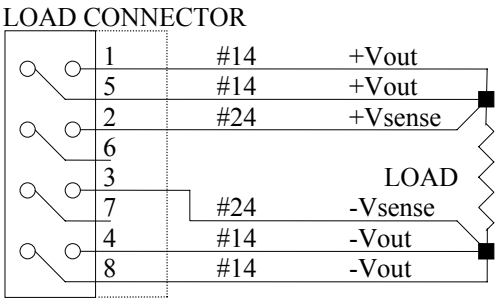
There are two load connectors in each module that provides over 40A: a main connector (labeled M) with the output lines and the sense lines, and a secondary connector (labeled S) with output lines only. Both connectors must be used, with their output lines connected in parallel.

WARNING

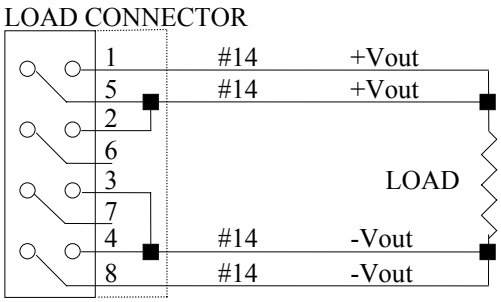
Be careful to connect both the main and the secondary connectors, and make sure they are in their right places. Interchanging between the connectors will leave open sense lines!

Load wiring for modules with single output connector

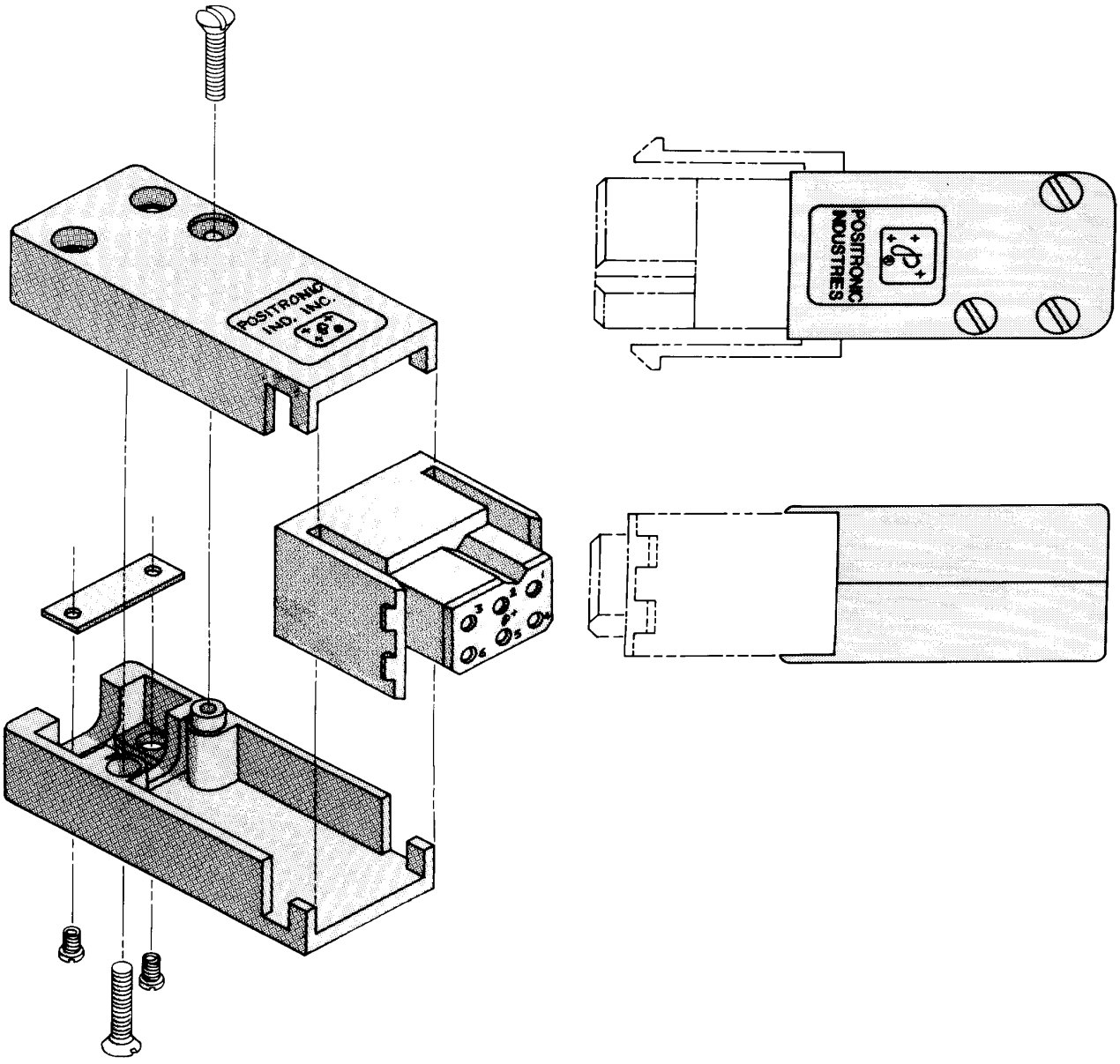
The following illustrations depict both the local and remote sensing connections, as well as the backshell installation.



Remote Voltage Sensing



Local Voltage Sensing

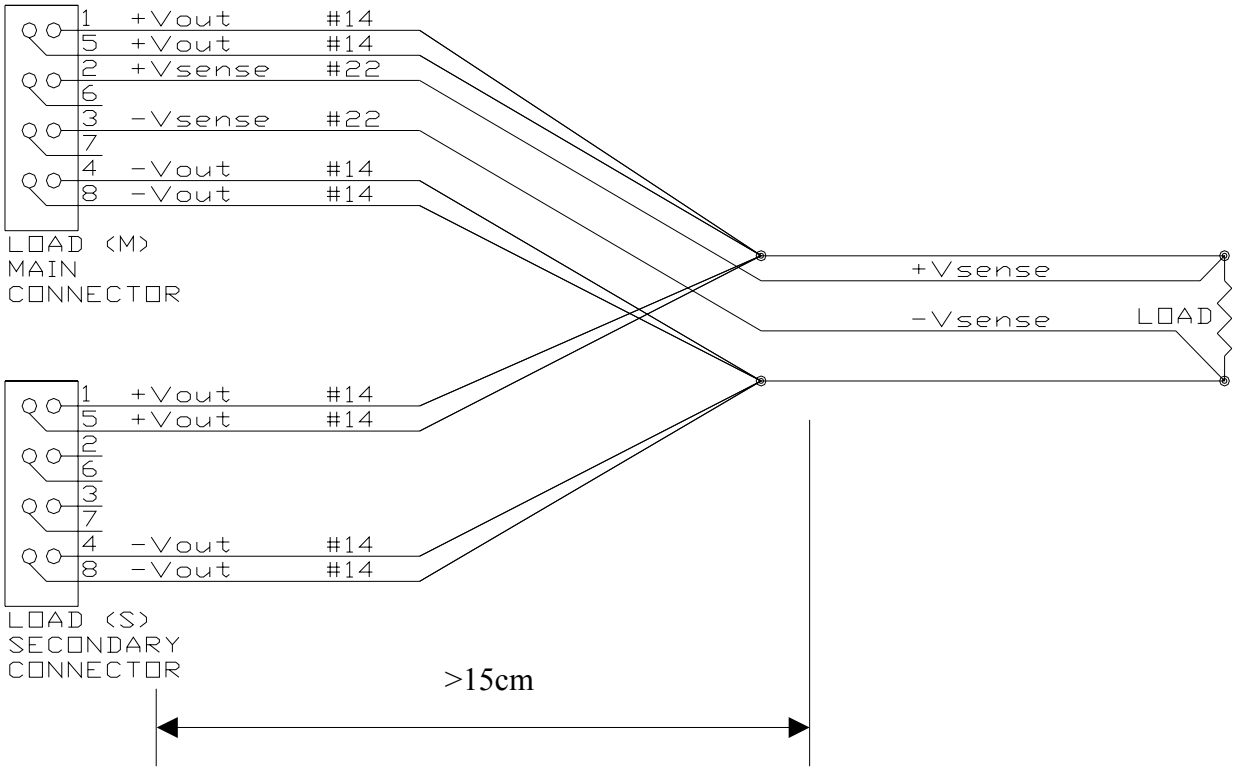


Backshell Installation

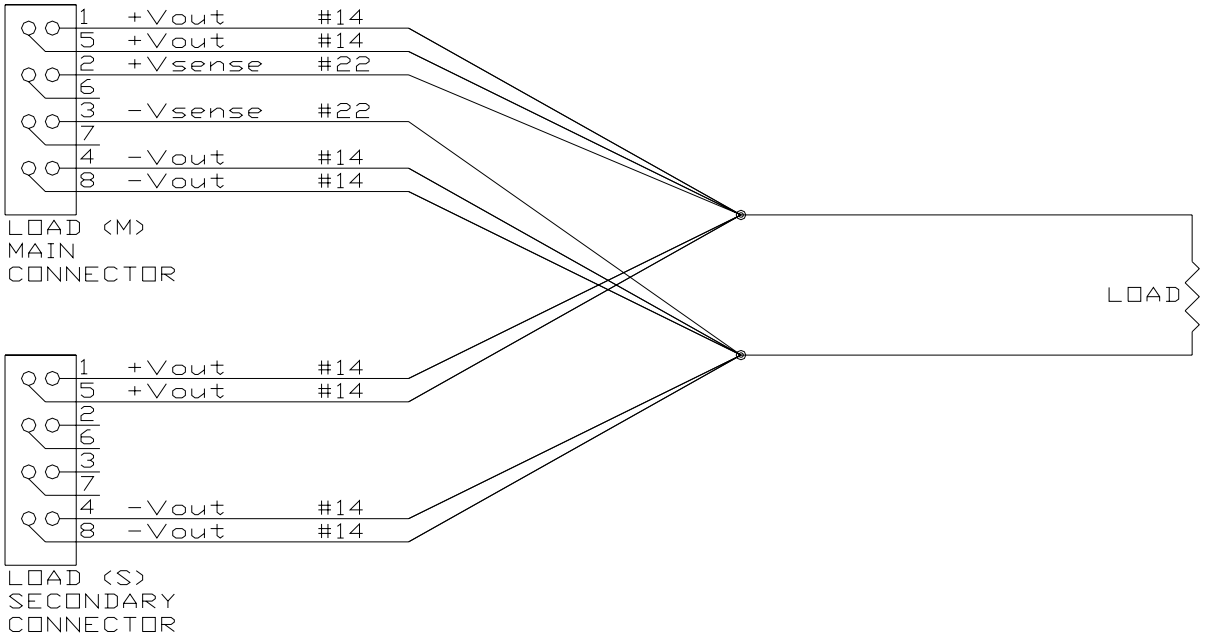
Load wiring for modules with dual connectors

The following illustrations depict both the local and remote sensing connections for modules with two output connectors (high current modules).

The following illustrations depict both the local and remote sensing connections.



Remote Voltage Sensing



Local Voltage Sensing

Power Module Replacement

In order to replace a power module in the XMP 2600, follow the next procedure:

Preparation

1) If you are about to replace a module or to install a new one, make sure you have nearby the new module to be installed.
2) Place the XMP 2600 on a working table.

> **WARNING**
>
> Make sure that the unit is not connected to the mains! Opening a mainframe connected to the mains may result in electric shock and personal hazard.

Open the unit

3) Turn the mainframe 90 degrees so the unit lays on it's left side, the ON/OFF switch is close to the table's surface, and the bottom cover is accessible.
4) Remove the ten screws that secure the bottom cover (including four screws in the mainframe legs') using a proper screwdriver.
5) Remove the bottom cover.

Remove the module

6) Locate the power module to be replaced.
7) Disconnect the flat cable from the module.
8) Unscrew the three screws securing the power module's bottom.
9) Rotate the unit so the top cover becomes accessible.
10) Remove the ten screws that secure the top cover.
11) Remove the conical screw (near the fans) that secures the power module to be removed.
12) Pull the module out gently, then shift it towards the fans. It will slide about one cm (0.4"). Make sure the module's rear connector is free from the rear panel, then pull the module out.

Install a module

13) Push the new module in, then slide it gently so it's rear connector enters through the rear panel correctly.
14) Return the three screws that were previously removed from the bottom side of the unit, securing the module's bottom. Make sure to close the screws tightly.
15) Connect the flat cable to the module.
16) Return to it's place the conical screw that was previously taken out from the top side of the module (near the fans) securing it tightly.
17) Near the fans, locate a small opening in the top side of the new module. Inside you will note eight switches. Set them like the switches in the removed module, so that the new module will appear in the same slot number as the old one.

Close the unit

18) Reinstall the top cover in its place, securing it with its ten screws.
19) Reinstall the bottom cover in its place, securing it with its ten screws (including four screws in the mainframe legs').
20) Place the XMP 2600 horizontally on the table.

Operate the unit

21) Perform a turn-on checkout in order to confirm the new module operation (as explained in the next section).
22) If the module was replaced by a module of different rating, the unit will show a question mark in the LCD display (in the front panel) at the place corresponding to the replaced module (at the same address).

23) When in the Set-Up Mode of operation, as you place the cursor over the question mark (by using the left and right arrow keys), the unit will ask you if this is a new module. Press the "ENTER" key to confirm.
24) The XMP 2600 will then read the module's parameters and ask the operator if these are correct. Press the "ENTER" key to confirm. Turn off the unit.
25) The unit is ready to operate. Perform a second turn-on checkout in order to confirm the new module operation (as explained in the next section).

3 Turn-On Checkout

Power-on self-test

As power is applied to the Power Supply, the Power Modules and the Main Controller undergo internal testing of the control circuits.

Power Modules

At power-on, the Power Modules perform the following tests:

- Processor Memory.
- Program Memory.
- Control circuits` power supplies.
- Analog section reference voltage.
- Digital to Analog Converter.
- Analog signal paths.
- Non-Volatile Memory.

The results of the Power-on tests are available to the Main Controller.

Main Controller

The Main Controller performs, at power-on, the following tests:

- Program Memory.
- Processor Memory.
- Visual display, indicators and buzzer test.
- Main Memory.
- Internal Tables (initialized if in error).

Power-on auto configuration

Following the power-on self-test, the Main Controller scans all the channels, looking for installed Power Modules. As the scan progresses, the lower row of the display shows the state (condensed status) of the scanned channels.

Retain and Initialize

Following a successful scan of the installed Power Modules, the Power Supply will set the initial Power Modules state to either the last known state (before power was turned off) or to a predefined idle state.

Retain

If the Power On Retain (POR) flag is set, all the Power Modules will be programmed to the state they were in just before power was turned off. The state of the Global Output Enable condition will, also, be restored.

Initialize

If the Power On Retain flag is cleared, all the Power Modules will be programmed to the following conditions:

- Output Voltage set to 0.
- Output Current limit set to minimum.
- Output disabled.
- Protection mode set to Auto (tracking).
- All other features are disabled.

The Global Output Enable condition will be set false (global disable).

Scan Exceptions

During scan, the Channel state will show a question mark ("?") if there is any miss-match between the previous state of the installed Power Module and the current state.

Once the scan is done, channels will get their permanent state, except for a situation where the scanned channel was found to have a different (than was know) kind of Power Module installed. In this case, the question mark state will remain for the user to resolve. This type of scan error can not be resolved automatically because it may indicate that a Power Module was replaced with a different kind of module, but it might, also, indicate a defective Power Module.

To resolve this situation, select the Power Module in Set-Up Mode. The Power Supply will present some guiding questions to be answered by selecting "YES" or "NO". Use the Flip (up and down arrow) keys to select the proper answer and press ENTER to confirm. If the Power Module in question is not new or its data is not what was expected then the Power Module will be rendered NON-OPERATIONAL. In such a case, refer the unit to a qualified maintenance laboratory.

Testing the modules

Power Modules can be tested in two levels: Control Circuit Confidence Test and Power Module Test.

Confidence Test

In Channels Status Mode (default operating mode following power-on), select the Power Module to be checked - use the selection (left and right arrow) keys to move the cursor to the channel where the Power Module is installed.

Using the Flip (up and down arrow) keys, select to display the MAX values. MAXimum Voltage and Current available from the Power Module are displayed. In this mode the system, continuously, performs a confidence test of the selected Power Module with the results being displayed as: "BIT=00,00". The equal sign ("=") blinks to indicate the repeated performing of the confidence test. For details on the result of the BIT see the Status Reporting section of the Programming Manual.

The Confidence Test performs the following checks:

- Processor Memory.
- Control circuits` power supplies.

- Analog section reference voltage.
- Digital to Analog Converter.
- Analog signal paths.

Power Module Test

> Power Module Test must be performed with no load and with the sense lines connected to the Power Module's output.

Place the cursor at the System Symbol ("Σ" at the right most position of the lower row of the display) and press the SET key. This will change the Power Supply's operating mode to the Set-Up Mode.

In Set-Up Mode, select the Power Module to be checked. Use the selection (left and right arrow) keys to move the cursor to the channel where the Power Module is installed.

Press the SET key to initiate a pre-test dialogue. To each question presented by the Power Supply, select the proper answer ("YES" or "NO") using the Flip (up and down arrow) keys.

The First question is to confirm the desire for the Test operation. The next two questions guide you to get the Power Module into the correct state (no load and sense lines connected) for the Test operation.

The Test operation lasts a few seconds. During the test, the following is being checked:

- Processor Memory.
- Program Memory.
- Control circuits` power supplies.
- Analog section reference voltage.
- Digital to Analog Converter.
- Analog signal paths.
- Vout at zero.
- Iout at zero during output checks.
- Vout at ½ the full scale output voltage.
- Over Voltage Protection circuit trip.
- Over Voltage Protection circuit reset.

CAUTION

During the test operation the Power Module's output might produce up to its rated voltage.

The test results, shown when the test operation is done, are either "OK" or two Hex numbers representing the two test result bytes (for details, see the Status Reporting section of the Programming Manual).

The test operation can be aborted by pressing any key while the test is running.

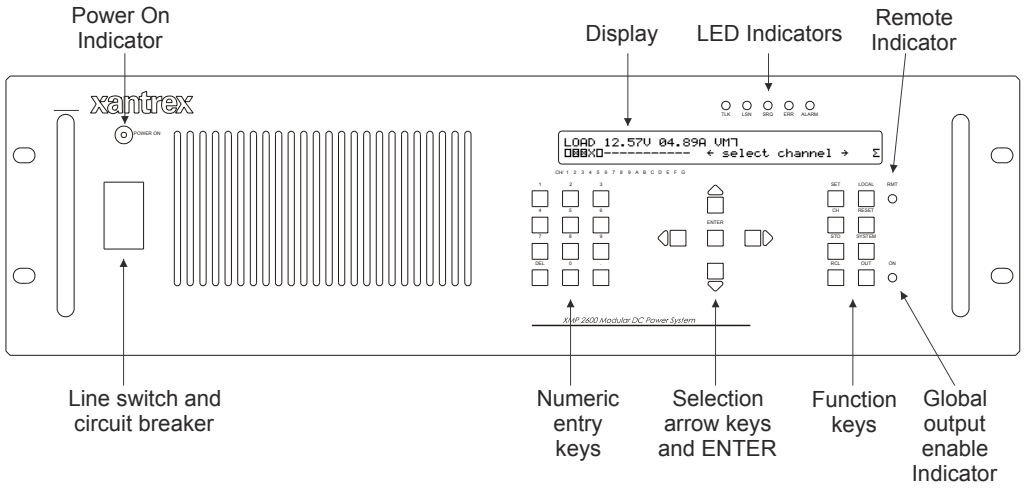
When the test operation is done (or aborted) the Power Module undergoes a complete reset.

4 Using the front panel

This chapter describes the front panel with its display, keys and indicators. It provides detailed description on how to operate the XMP 2600 using its front panel but does not go into programming it. Description of the available status information is also provided.

Front panel description

The following illustrates the elements comprising the front panel of the XMP 2600:



Operating modes

The front panel is the user's interface for controlling the XMP 2600 locally.

The user's interface can function in one of several operating modes: status, programming or setup. There are two additional operating modes that deal specifically with the sequence program: sequence program editing and sequence program run.

Detailed information on each of the operating modes is presented throughout this user's guide.

The following paragraphs describe each of the elements found on the front panel.

Line Switch and Indicator

The LINE Switch is also a circuit breaker, which protects from excessive mains current.

The Indicator lights whenever the internal supplies provide power to the controlling circuits.

LED Indicators

The seven LED indicators serve the functions detailed in the following table:

LED name	Meaning when lit
TLK	The Power Supply is talking to the remote controlling device
LSN	The Power Supply is receiving from the remote controlling device
SRQ	An SRQ enabled event occurred. The indicator is turned off when the remote controlling device has queried the Power Supply's Status Byte
ERR	A system error occurred. The error code is shown on the display when system status is displayed. The indicator is turned off when the remote controlling device has queried the Power Supply's error code
ALARM	Attracts the attention of the operator to status information on the display
RMT	The Power Supply is being remotely controlled and local programming and setup functions are disabled
ON	Power Modules are globally enabled

The LCD display

The front panel LCD display of the XMP 2600 shows diverse information depending on the current operating mode (status, programming, setup, sequence program editing or sequence program run).

The LCD display has two rows of text that, generally speaking, function as follows:

- The lower row of the display contains symbols that represent XMP elements or functions.
- The upper row of the display shows details on the element selected (as indicated by the cursor) in the lower row.

The cursor (a blinking black rectangle) indicates a selected element on the display. In the module programming mode of operation, the cursor appears as an underline.

The above outlined method of displaying information is maintained, with small variations, among the different operating modes. The information displayed is made out of at-a-glance condensed status and detailed status.

Navigating through horizontal and vertical menus and selections choose the information to be displayed or programmed.

A detailed description of the displayed information, in each operating mode, is given later on in this user's guide.

Numeric entry keys

This group of keys is used for numeric entry. The function of each key is detailed in the following table:

key	Function
0…9	Used for entering numeric values to system and modules parameters and selections.
Decimal Point (“.”)	Used, in conjunction with the digit keys, for entering values. The Decimal Point key is used for changing the relative value of the digits entered.
DEL	Used for clearing selected values or digits and for canceling certain operations.

Note that numeric values can also be changed using the up and down selection (“flip”) keys, as detailed below.

Selection and enter keys

This group of keys is made up of the four selection (or arrow) keys and the enter key. The following paragraphs specify the function of each type of key.

Selection (arrow) keys

The selection (arrow) keys are used for navigating through the Power Supply Menus.

Arrow key	Function
LEFT RIGHT	The Left and Right arrow keys are used for horizontally selecting items to be displayed or programmed.
UP DOWN	The Up and Down arrow keys have two functions: ◆ Vertically selecting items to be displayed or programmed. ◆ “flipping” (changing) numeric values or selections.

Enter key

The main function of the enter key is to confirm selections and entered values, but it also has secondary functions, as detailed in the following table:

Operating mode	Function
Any data entry	Confirm selections and numeric inputs
Programming	Select the next item to be programmed
Sequence program run	Shorten the current step’s delay to zero.

Function keys

All function keys have a major function and most of them have one or more secondary functions (depending on the operating mode).

The following table summarizes the major function of the function keys, while the following paragraphs detail individual key functions.

Key	Major function
SET	Change operating mode: enter into / exit from programming and set-up modes
CH	Navigate to (select on the display) a specific channel (or module)

Key	Major function
STO	Store system-wide modules settings
RCL	Recall a previously stored system-wide modules settings
LOCAL	Return the Power Supply to LOCAL control (enabling programming and set-up of its parameters from the front panel) after a remote device has controlled it.
RESET	Reset faults and error indications
SYSTEM	Navigate to (select on the display) the system symbol
OUT	Globally enable (turn on) or disable (turn off) the power modules

> A short form card, "XMP 2600 Function Keys", is available to help you with the secondary functions of the function keys.

The SET function key

The SET key is, generally, used for changing the operating mode (entering into / exiting from programming and set-up operating modes). The following table summarizes the functions of the SET key:

Operating mode	Cursor location	Function
Module status	Module symbol	Go into module programming mode
Module programming	Any	Go into module status mode
System status	System symbol	Go into setup mode
Setup	GPIB or SERIAL	Go into communication link setup
Setup	System symbol	Go into system status mode
Sequence program editing	Any	Go into system status mode

The CH function key

The CH key is mainly a navigation aid and has the functions summarized in the following table:

Operating mode	Cursor location	Function
Module / system status	Any	Open numeric entry for navigating directly to a specific channel (module address). Enter two digits or one digit and ENTER.
Module programming - SET parameters	Any	Change the module's output polarity

The STO function key

The following table summarizes the functions of the STO function key:

Operating mode	Cursor location	Function
Module status	Module symbol	Initiate a STORE operation. Press a digit (0 to 9) for the storage number and confirm with ENTER. Press DEL to cancel. This operation stores the settings of all the modules.
Module programming - SET parameters	Any	ARM the Power Module. All new PROTECTION and SET values programmed for that Power Module do not affect the output. A subsequent hardware or software trigger will cause the Power Module to perform a selected task.
System status	System symbol	Enter sequence program editing
Module Setup	Module symbol	Initiate manual calibration

The RCL function key

The following table summarizes the functions of the RCL function key:

Operating mode	Cursor location	Function
Module status	Module symbol	Initiate a RECALL operation. Press a digit (0 to 9) for the storage number and confirm with ENTER. Press DEL to cancel. This operation restores the settings of all the modules.
Module programming - SET parameters	Any	TRIGGER the Power Module, causing it to perform a selected task.
System status	System symbol	Run the sequence program
System Setup	System symbol	Displays the Mainframe Controller's firmware version string on the upper row of the display (the same string as can be read remotely using the ROM? Command).
Module Setup	Module symbol	Display Power Module's Serial Number, Calibration date, Options and EVENT register. Pressing RCL a second time displays the Power Module's Revision and Date codes.

The LOCAL function key

This key is used for returning the Power Supply to LOCAL control (enabling programming and set-up of its parameters from the front panel) after a remote device has been controlling it.

During manual calibration, the LOCAL key is used for aborting the calibration process.

The RESET function key

The RESET key is used for resetting faults and error indications:

Operating mode	Cursor location	Function
Module status	Module symbol	Reset any Power Module faults and errors
System status	System symbol	Reset any system error or fault. If the main converter has been shutdown then the Power Supply will undergo a full reset.
Module Setup	Module symbol	Reset the Power Module to its power-on state
Sequence program editing	Any	Initiate program erasure
Sequence program run	Any	Stop the program

The SYSTEM function key

The SYSTEM key is mainly a navigation aid and has the functions summarized in the following table:

Operating mode	Cursor location	Function
Status mode	Any	Move the cursor to the system symbol
Setup mode	Any	Move the cursor to the system symbol
Module programming - SET parameters	Any	Causes the output disconnect relay to open or close (toggle operation)

The OUT function key

The OUT function key controls the state of the Power Modules output:

Operating mode	Cursor location	Function
Module programming	Any	Toggle the individual output on or off

Operating mode	Cursor location	Function
Status mode	Any	Toggle the global enable state of the outputs (as depicted by the ON indicator)
All other modes	Any	Globally disable all the outputs (if enabled)

> ↳ Keeping any key pressed for more than a second invokes repeat of the key function, at a rate of 10 times in a second.

Viewing status information

The following paragraphs detail the information shown on the LCD display in the two status display modes: system status and module status.

Modules condensed status

The left part of the lower row of the LCD display contains 16 symbols that represent the 16 available channels (module addresses) of the XMP 2600 mainframe. The captions on the front panel indicate the channel number associated with the symbol on the display.

> ↳ Channels 10 to 16 are marked with the letters A to G.

Each of the above mentioned symbols is a condensed status display for the power module installed in the associated channel (having the indicated address: 1 to 16).

The illustration below shows an example of power modules condensed status display.

Portion of the display showing condensed modules status

The meaning of each displayed symbol is summarized in the table below.

Condensed status symbol	Meaning of symbol
–	Channel is free – no power module is installed with that address.
▣	Power module is OK with its output turned off.
□	Power module is OK with its output turned on.
⨯	Power module is OK with its output disconnect relay open.
⁞	Power module has a fault (e.g. OVP, OCP etc.).
■	Power module is malfunctioning (e.g. it does not respond to communications from the main controller).

> ↳ When a warning or fault event occurs, the condensed status symbol blinks until the module is selected for detailed status viewing (see below).

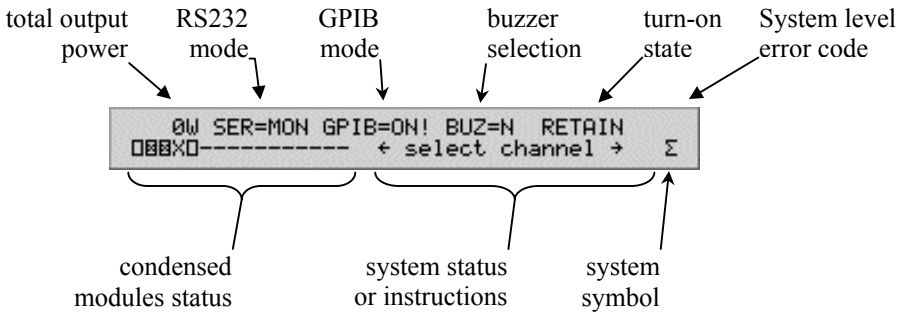
Viewing global system status

When the XMP 2600 is turned on (or following full reset) the cursor is located at the lower right corner of the display – at the system symbol: "Σ".

While the XMP 2600 is in status display mode with the cursor at the system symbol, the upper row of LCD display shows global power supply status.

What is displayed

The global power supply status, illustrated below, provide the user of the XMP 2600 with at a glance full status information about the current state of the power supply system and the installed power modules.



Display showing global power supply status

How to get there

To view global power supply status, you need to move the cursor to the system symbol and make sure the display is in status mode. To do that, follow the guidelines below:

IF…	Take the action…
Operating in programming mode (an underline cursor is visible at the upper row of the display)	Press the SET key to exit programming mode and press the SYSTEM key to move the cursor to the system symbol.
The cursor is not at the system symbol ("Σ")	Method 1: Press the SYSTEM key to move the cursor to the system symbol. Method 2: if the cursor (blinking black rectangle) is at the lower row of the display you can use the selection keys ← → to move the cursor to the system symbol.
The cursor is at the system symbol but the upper row shows other information.	Press the SYSTEM key, examine the information on the upper row of the display and act accordingly.
The cursor is at the system symbol but the upper row reads: "Power Supply Set Up"	Press the SET key to exit the setup mode and return to status mode.

IF…	Take the action…
You are unable to get the display you want using the instructions above.	Reset the power supply: Method 1: Press and hold the DEL key and then press LOCAL - the two keys must be pressed together. Method 2: recycle power using the line switch.

Display details

The table below summarizes the detailed system status information shown on the upper row of the display, from left to right:

Field	Displayed data
nnnnW	Total output power (as measured at the output connectors), in watts, delivered by the master mainframe.
SER=	Operating mode of the RS232 communications link: ◆ OFF..... not used. ◆ CNT .... used for remote control (GPIB is OFF). ◆ MON... driving a remote monitor, giving full screen status display.
GPIB=	Operating mode of the GPIB communications link: ◆ OFF..... not used. ◆ ON!..... Used for remote control (RS232 may operate in monitor mode) with IEEE488.2 compatability.
BUZ=	Operating mode for the internal buzzer: ◆ N..... never makes a sound. ◆ F..... sounds off when a fault occurs. ◆ AL..... the buzzer is being used for all events: faults, warnings, wrong user entry, etc.
<system level error code>	The last known system level error code is displayed at the far right side of the display. The error code display is cleared when the reset key is pressed or when the error code is read or cleared by a remote controller.

The right portion of the lower row of the display shows system messages that provide:

- User guidance suitable for the active operating mode of the front panel.
- System fault messages.
- Temporary entry field (e.g. module number to select, storage area number, etc.).

See appendix A for a complete list of the system messages that may be displayed.

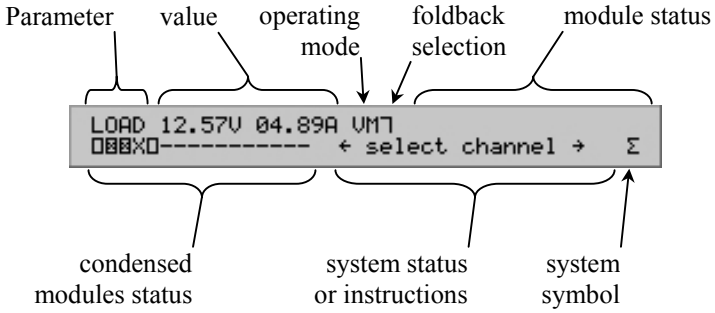
Viewing module status

When the front panel of the XMP 2600 operates in status mode and the cursor (blinking black rectangle) is placed over the condensed status symbol of a power module the upper row of the display shows detailed status information for the selected power module.

What is displayed

When operating in module status mode, the upper row of the display shows diverse information on the condition and setup of the selected power module.

The left part of the display's upper row shows output or parameters values while the right side, for the most part, shows power module status.



Display showing module's load values

By default, the display shows output values (voltage, current, operating mode and current limit selection) – either LOAD values (measured using the sense lines) or OUT values (measured at the output connector).

Other information may be selected for viewing using the UP and DOWN selection (arrow) keys. The format of the displayed information may change according to the parameter being selected for viewing (see "display details", later on).

How to get there

To view detailed power module status, the display must be operating in status view mode and the cursor must be placed over the condensed status symbol of the desired power module.

Use the table below to get the display into the proper mode.

IF…	Take the action…
The cursor is at the system symbol and the upper row shows system status information. OR The display shows status information for another power module.	Select the desired power module: Method 1: . Use the left and right selection (arrow) keys [←] [→] to move the cursor to the condensed status symbol of the desired power module. Method 2: press the [CH] key and in the entry field that opens at the lower row of the display, enter (using the numeric entry keys) a two digits module address or a single digit address followed by the [ENTER] key.

IF…	Take the action…
Operating in programming mode (an underline cursor is visible at the upper row of the display)	Press the SET key to exit programming mode and proceed to select the desired power module (see above).
The cursor is at the system symbol and the upper row reads: "Power Supply Set Up"	Press the SET key to exit the setup mode and return to status mode. Proceed to select the desired power module (see above).
The cursor is at the system symbol but the upper row shows other information.	Press the SYSTEM key, examine the information on the upper row of the display and act accordingly.
You are unable to get the display you want using the instructions above.	Reset the power supply: Method 1: Press and hold the DEL key and then press LOCAL - the two keys must be pressed together. Method 2: recycle power using the line switch.

Display details

System message

Instructs the user to use the LEFT and RIGHT selection keys to select a power module (channel).

Default display

When a power module is selected, by default, the display shows LOAD values. When you change the displayed data to be OUT values, this will be the new default display.

The new default display (OUT values) will remain in effect until you make a different selection or the XMP undergoes full reset.

Selecting data to display

Using the UP and DOWN selection (arrow) keys ↑ ↓ you can select other data for display. This selection is temporary – after a minute the display will revert to showing LOAD values.

The following table summarizes the data that can be selected for display. Pressing the DOWN selection key changes the displayed information down the table. Pressing the UP selection key changes the displayed information up the table.

The selection is cyclic: going up from the first row display the data shown on the bottom row and going down from the bottom row display the data shown on the top row (i.e. LOAD values and OUT values are only a single click away from each other).

Parameter	Displayed data (left to right)
LOAD	◆ Output voltage as measured by the sense lines and load current. ◆ Operating mode: VM=voltage mode (operating as a voltage source), CM=current mode (operating as a current source), FB=foldback is active. ◆ Foldback selection (see below). ◆ Detailed module status (see below).
SET	◆ Programmed output voltage and current limit (or voltage limit and output current if operating as a current source). ◆ Operating mode: VM=voltage mode (operating as a voltage source), CM=current mode (operating as a current source), FB=foldback is active. ◆ Foldback selection (see below). ◆ Detailed module status (see below).
RIPL	◆ Selection of simulated ripple at the module's output: level (OFF, LOW or HIGH) and frequency (50Hz, 60Hz, 100Hz, 120Hz, 400Hz, 800Hz, 2KHz). ◆ Operating mode: VM=voltage mode (operating as a voltage source), CM=current mode (operating as a current source), FB=foldback is active. ◆ Foldback selection (see below). ◆ Detailed module status (see below).
PROT	◆ Over voltage and over current protection threshold levels. ◆ Protection levels programming method: AUT=automatic (auto-tracking) or MAN=manual (user programmed). ◆ Detailed module status (see below).
MAX	◆ Power module ratings: voltage and current. ◆ Operating mode: VM=voltage mode (operating as a voltage source), CM=current mode (operating as a current source), FB=foldback is active. ◆ Foldback selection (see below). ◆ BIT=00,00 the power module, continuously, performs built-in-tests with the results displayed as two numbers. The equal sign flashes as each cycle of BIT is performed.
LIM	◆ Voltage and current values that serve as limits on the allowed output values to program (SET parameter). ◆ Operating mode: VM=voltage mode (operating as a voltage source), CM=current mode (operating as a current source), FB=foldback is active. ◆ Foldback selection (see below). ◆ Detailed module status (see below).

Parameter	Displayed data (left to right)
HIGH	◆ Voltage and current thresholds for the high voltage and current portion of the window warning mechanism. ◆ State of the high voltage and current window warning mechanism: ON or OFF. ◆ Detailed module status (see below).
LOW	◆ Voltage and current thresholds for the low voltage and current portion of the window warning mechanism. ◆ State of the low voltage and current window warning mechanism: ON or OFF. ◆ Detailed module status (see below).
SYNC	◆ Selection of a module condition that will cause a SYNC signal to be generated. The SYNC signals from all the modules are summed to produce the output at the rear of the XMP's mainframe. ◆ Operating mode: VM=voltage mode (operating as a voltage source), CM=current mode (operating as a current source), FB=foldback is active. ◆ Foldback selection (see below). ◆ Detailed module status (see below).
TRIG	◆ Selection of the module's response to a hardware or software trigger. Hardware trigger signal can be fed at the rear of the XMP's mainframe. The signal is distributed to all the power modules in the mainframe. ◆ Detailed module status (see below).
OUT	◆ Output voltage and current as measured at the output connector. ◆ Operating mode: VM=voltage mode (operating as a voltage source), CM=current mode (operating as a current source), FB=foldback is active. ◆ Foldback selection (see below). ◆ Detailed module status (see below).

Foldback selection (current limitation scheme) indication

The behavior of the XMP's power module when operating in current mode (current source) is user selectable.

The following table summarizes the available selections along with the symbol representing each one. For more details on the behavior of the power module's output please refer to the basic operation chapter later on in this manual.

Foldback symbol	Meaning of symbol
⅂	No foldback … the power module's behavior changes from a voltage source to a current source depending on the connected load (constant voltage or constant current).
⅂	Linear foldback ... when the current limit is reached, the power module's output voltage decreases (down to 0) as does the output current (down to 30% of the current SET value, at short circuit).
⅂	Non-linear foldback … when the current limit is reached, the power module's output voltage decreases (down to 70% of the voltage SET value) while the output current stays constant. Beyond that point, the output current decreases as well (down to 30% of the current SET value, at short circuit).
⅂	Retry …… when the current limit is reached, the Power Module shuts-down it's output for a period of 3 seconds. Then, the output is restored for 1 second. If the current limit is still valid the cycle repeats itself. Up to 5 consecutive retries are performed until the Power Module declares an error condition and its output stays shut.
⅄	Shutdown … when the current limit is reached the power module shuts down and a fault is generated.

Detailed module status

The detailed module status is divided into three levels of severity: information, warnings and faults. The display will show status information for the highest severity, hiding information relating to lower severity.

The following table summarizes the displayed detailed module status, according to its degree of severity:

Severity	Displayed data	Description
Information		Blank display – nothing to show
	NOT CALIBRATED	You should never see this
	DISCONNECTED	Output disconnect relay is open
	* ARMED *	The module is armed, waiting for trigger
	RIPL lv frq	Simulated output ripple is active with: Level .....lv = LO or HI Frequency .frq = 50 or 60 or 100 or 120 or 400 or 800 or 2 KHz

Severity	Displayed data	Description
Warnings	m wv wc t ERR nnn	m.....operating mode: ◆ blank ...voltage mode ◆ M.....current mode ◆ F.....foldback wv.....window voltage warning: ◆ blank ...no warning ◆ LV .....low voltage ◆ HV.....high voltage wc.....window current warning: ◆ blank ...no warning ◆ LC .....low current ◆ HC.....high current t.....over temperature ERR nnn..error with error code nnn
Faults	s fault t ERR nnn	s.....open sense lines: ◆ blank ...no fault ◆ mode ...operating mode (see above) ◆ S.....open sense fault fault.....fault indication: ◆ blank ...no fault ◆ warn ....window warning (see above) ◆ *OVP* over voltage protection ◆ *OCP* over current protection t.....over temperature ERR nnn error with error code nnn

More information on the power modules and their setup is available in the setup operating mode chapter. Please refer to the power supply setup chapter for more information.

5 First operation steps

This chapter will guide you through the first steps of manually programming the XMP 2600 power supply system. Before reading this chapter you need to familiarize yourself with the description of the front panel that was presented in the previous chapter.

Step 1: program output voltage and current

To start with, you will leave all other power module parameters at their default values and program a power module for the desired output voltage and current.

Select a power module

First you need to select the power module you wish to program. To do that, you need to make sure the front panel is in the status operating mode.

Start from status mode

Make sure the cursor (blinking black rectangle) is at one of the following positions:

- The cursor is at the system symbol ("Σ") and the upper row of the display shows the global power supply status (the display will be in that state following turn on).
- The cursor is at one of the condensed power module status symbols and the upper row of the display shows power module status information.

Use the table below if you need to get the display to the state described above:

IF…	Take the action…
Operating in programming mode (an underline cursor is visible at the upper row of the display)	Press the SET key to exit programming mode.
The cursor is at the system symbol but the upper row shows other information.	Press the SYSTEM key, examine the information on the upper row of the display and act accordingly.
The cursor is at the system symbol but the upper row reads: "Power Supply Set Up"	Press the SET key to exit the setup mode and return to status mode.

IF…	Take the action…
You are unable to get the display you want using the instructions above.	Reset the power supply: Method 1: Press and hold the DEL key and then press LOCAL - the two keys must be pressed together. Method 2: recycle power using the line switch.

Select the power module to program

Now you select the power module to be programmed using one of the following methods:

Moving the cursor ..... Use the left and right selection (arrow) keys ← → to move the cursor to the condensed status symbol of the desired power module.

Jumping to channel..... press the CH key and in the entry field that opens at the lower row of the display, enter (using the numeric entry keys) a two digits module address or a single digit address followed by the ENTER key.

The display should show either LOAD or OUT values. If it does not, use the up and down selection keys to change the displayed information.

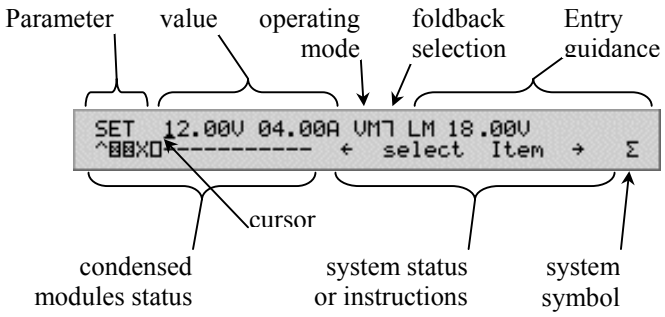
Enter programming mode

Press the SET key to enter programming mode. The blinking black rectangle is now replaced with a blinking carrot ("^") and the cursor is moved to the upper row of the display where it appears as an underline ("_") under the voltage value.

What is displayed

When operating in programming mode, the upper row of the display allows you to program various power module parameters.

The left part of the display's upper row shows the parameter's name and the values associated with it, while the right side gives you entry guidelines.



Display in programming mode showing SET values

How to get there

While in status mode, select the module, and click the SET key to enter programming mode.

Display details

System message

Instructs the user to use the LEFT and RIGHT selection keys to select an item to change: voltage, current or foldback selection.

Values to program

The left side of the display shows the name of the parameter being modified along with its associated value(s). In this instance we are programming SET values: desired output voltage and current.

Entry guidance

The right side of the display shows the parameter (and its value) that is limiting the value that we can enter for the item selected by the cursor. In the example shown, the LIM voltage value is limiting the value that can be programmed for the SET voltage.

Enter voltage and current values

There are two methods (with variations) available for changing numeric values. For now you should use the simplest approach, demonstrated below.

Enter desired output voltage

Using the numeric entry keys, enter the desired value, noting the following:

- You do not have to enter leading zeros. If, for example, the power module can be programmed up to 18.00 volts and you wish to program it to 4 volts – just enter 4 and not 04.
- When you click the decimal point key, the entered value is aligned with the correct dot position.
- You may delete the last digit using the DEL key.

When you are done with the value for voltage, one of two things may happen:

The value occupies the entire voltage field and the cursor has already moved to the value for current.

OR

You will need to press the ENTER key to confirm the value for voltage and move the cursor to the value for current.

Note how the entry guidance message is changed as well.

> ↳ A more complete description of numeric entry is presented in the next chapter.

Enter desired output current limit

Using the numeric entry keys, enter the desired value for the output current limit.

Exit programming mode

Press the SET key to exit programming mode. The cursor returns to the lower row of the display and the upper row shows SET values (in status mode).

> If you wish to turn the module on or off, do not exit the programming mode and read the step 2 paragraph.

Step 2: turn the power module on

In step 1 you have programmed the desired output voltage and current limit. Now you need to turn the module on, enabling its output.

If the display is already in module programming mode, skip to the paragraph on how to actually turn the module ON or OFF.

Select a power module

Otherwise, you'll need to select the power module you wish to turn on. Follow the steps below to do that.

Start from status mode

Before you can select the desired power module you need the display to be in status mode.

Use the guidelines presented in step 1 in order to go to status mode.

Select the power module to program

Now you can select the power module to be programmed using one of the following methods:

Moving the cursor ..... Use the left and right selection (arrow) keys ← → to move the cursor to the condensed status symbol of the desired power module.

Jumping to channel..... press the CH key and in the entry field that opens at the lower row of the display, enter (using the numeric entry keys) a two digits module address or a single digit address followed by the ENTER key.

Enter programming mode

Press the SET key to enter programming mode. The blinking black rectangle is now replaced with a blinking carrot ("^") and the cursor is moved to the upper row of the display where it appears as an underline ("_") under the voltage value.

The step 1 section (program output voltage and current), above, has a comprehensive description of what is shown on the LCD display.

Turn the module on or off

Press the OUT key to change the state of the power module's output to ON or OFF.

You can verify the state of the power module's output by looking at it's condensed status symbol (at the display's lower row, where the blinking carrot is):

output is on (enabled).

output is off (disabled).

For details on the condensed status symbol of a power module, please refer to the section on reading status, earlier in this chapter.

Exit programming mode

Press the SET key to exit programming mode. The cursor returns to the lower row of the display and the upper row shows SET values (in status mode).

Press the UP selection key to change the display to show LOAD (output) values.

Step 3: globally enable power modules outputs (global on)

Turning on a specific power module is not sufficient for enabling its output.

In addition to controlling the state of the individual power module's output, the XMP 2600 has a global output enable/disable feature (global on).

The OUT indicator, at the lower right corner of the front panel, indicates the state of the global output enable feature. When the indicator is on – outputs are globally enabled.

> Global output enable will not turn on (enable) power modules that their outputs are individually turned off (disabled).

Start from status mode

Make sure the cursor (blinking black rectangle) is at one of the following positions:

- The cursor is at the system symbol ("Σ") and the upper row of the display shows the global power supply status.
- The cursor is at one of the condensed power module status symbols and the upper row of the display shows power module status information.

Use the table below if you need to get the display to the state described above:

IF…	Take the action…
Operating in programming mode (an underline cursor is visible at the upper row of the display)	Press the SET key to exit programming mode.
The cursor is at the system symbol but the upper row shows other information.	Press the SYSTEM key, examine the information on the upper row of the display and act accordingly.
The cursor is at the system symbol but the upper row reads: "Power Supply Set Up"	Press the SET key to exit the setup mode and return to status mode.
You are unable to get the display you want using the instructions above.	Reset the power supply: Method 1: Press and hold the DEL key and then press LOCAL - the two keys must be pressed together. Method 2: recycle power using the line switch.

Global enable

Press the OUT key to toggle the state of the global output enable feature (turn the power supply system ON and OFF).

You can verify the state of the global enable feature by looking at the out indicator located next to the OUT key: when the indicator is on – outputs are globally enabled.

> For a power module to provide power at its output, all the following conditions must be met:
>
> - The Main Converter is operating.
> - The power modules are globally enabled (global on).
> - The Power Module is turned on (individually enabled).
> - The Power Module does not report any fault.
> - The output disconnect relay is closed.

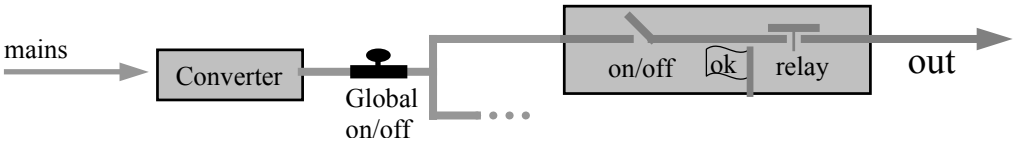


Illustration of conditions needed for producing an output

You can select an active power module (one that is individually enabled [turned on]) and view its output values. Please refer to the “Using the front panel” chapter.

6 Basic operation

This chapter provides you with basic operating instructions when manually programming the XMP 2600 power supply system. Before reading this chapter you need to familiarize yourself with the description of the front panel and the first operation steps that were presented in the previous chapters.

> A quick reference guide is supplied with the unit to help you with the basic operations.

Programming power module parameters

This section describes, in general terms, the procedures for programming power module parameters:

- Selecting the parameter to program.
- Setting voltage / current values.
- Selecting values for other parameters.

Selecting a parameter to program

There are two ways to select a parameter to program:

- Select a parameter in status mode and press the SET key to enter programming mode.
- While in programming mode, browse through available parameters.

Selecting a parameter in status mode

When entering programming mode, the parameter that appears on the display, ready to be programmed, depends on the parameter that was shown in status mode – just before the SET key was pressed.

The table below summarizes the relation between the parameter shown in status mode and the parameter that opens for programming when the SET key is pressed:

Parameter displayed in status mode	Press SET to program
OUT – output values, measured at the output connector	SET – output settings (voltage, current limit and current limit scheme)
LOAD – voltage and current measured using the sense lines	
SET – output settings	
RIPL – simulated output ripple selection	RIPL – simulated output ripple selection
PROT – OVP and OCP thresholds	PROT – OVP and OCP thresholds
MAX – power module ratings	LIM – soft programming limits
LIM – soft programming limits	
HIGH – high window warning thresholds	HIGH – high window warning thresholds
LOW – low window warning thresholds	LOW – low window warning thresholds
SYNC – event that generate a sync	SYNC – event that generate a sync
TRIG – response to a trigger	TRIG – response to a trigger

To select a parameter to program, follow the guidelines below:

- While in status mode, use the UP / DOWN select keys to select a parameter for viewing (left column in the table above).
- Press the SET key to enter programming mode. The parameter that opens for programming is the one shown on the right column of the table above.

Selecting a parameter in programming mode

While in programming mode, you may select a different parameter to be programmed. To do that, folow the guidelines bellow:

- Move the cursor to the name of the parameter being programmed. Use the LEFT / RIGHT (←) (→) selection keys or the ENTER key to move the cursor.
- With the cursor at the name of the parameter being programmed, use the UP / DOWN selection keys to browse through available parameters.
- When the desired parameter name appears, press the RIGHT (→) selection key or the ENTER key to move the cursor to the parameter's value.

The following table shows the parameters that can be selected for programming. Pressing the DOWN selection key selects the parameter down the table. Pressing the UP selection key selects the parameter up the table.

The selection is cyclic: going up from the first row selects the parameter shown on the bottom row and going down from the bottom row selects the parameter shown on the top row.

Parameter	Values to program (left to right)
SET	◆ Output voltage and current limit (or voltage limit and output current if operating as a current source). ◆ Current limiting scheme (Foldback selection).
RIPL	◆ Simulated ripple at the module's output: level (OFF, LOW or HIGH) and frequency (50Hz, 60Hz, 100Hz, 120Hz, 400Hz, 800Hz, 2KHz).
PROT	◆ Over voltage and over current protection threshold levels. ◆ Protection levels programming method: AUT=automatic (auto-tracking) or MAN=manual (user programmed).
MAX	(none – shown for reference only)
LIM	◆ Voltage and current values that serve as limits on the allowed output values to program (SET parameter).
HIGH	◆ Voltage and current thresholds for the high voltage and current portion of the window warning mechanism. ◆ State of the high voltage and current window warning mechanism: ON or OFF.
LOW	◆ Voltage and current thresholds for the low voltage and current portion of the window warning mechanism. ◆ State of the low voltage and current window warning mechanism: ON or OFF.
SYNC	◆ Selection of a module condition that will cause a SYNC signal to be generated. The SYNC signals from all the modules are summed to produce the output at the rear of the XMP's mainframe.
TRIG	◆ Selection of the module's response to a hardware or software trigger. Hardware trigger signal can be fed at the rear of the XMP's mainframe. The signal is distributed to all the power modules in the mainframe.

Parameters value limits

Voltage and current values associated with parameters (e.g. SET, PROT, HIGH) have upper and lower limits on their allowed value.

Lower and upper limits

The following table lists the upper and lower limiting values for each parameter:

Parameter	Value	Lower limit	Upper limit
SET	Voltage	0V	The lower of: Vmax, OVset, Vlim
	Current	Imin	The lower of: Imax, OCset, Ilim
PROT	Voltage	Vset	Vmax + 10%
	Current	Iset	Imax +10%

Parameter	Value	Lower limit	Upper limit
LIM	Voltage	Vset	Vmax
	Current	Iset	Imax
HIGH	Voltage	Vset	Vmax
	Current	Iset	Imax
LOW	Voltage	0V	Vset
	Current	0A	Iset

Displayed entry guidance (limit value)

When you program a value for a parameter that has voltage and current values, the right side of the display's upper row shows the most relevant limit on the allowed value to program. The table below summarizes the displayed limiting values:

Parameter	Value	Displayed limit	Remarks
SET	Voltage	Upper: LM or OV	The lower of Vlim or OVset
	Current	Upper: LM or OC	The lower of Ilim or OCset
PROT	Voltage	Lower: SE	Vset
	Current	Lower: SE	Iset
LIM	Voltage	Upper: MX	Vmax
	Current	Upper: MX	Imax
HIGH	Voltage	Lower: SE	Vset
	Current	Lower: SE	Iset
LOW	Voltage	Upper: SE	Vset
	Current	Upper: SE	Iset

Limit indication

When you try to program a value outside its allowed range, the value is not accepted and a warning message ("*** VALUE LIMIT ***") is displayed on the display's lower row.

If the internal buzzer is set to "always" (see the chapter on power supply setup) – a short beep will be heard as well.

Changing voltage or current values

The XMP 2600 provides you with two methods for changing voltage and current values when programming a power module's parameter:

- Entering a numeric value (using the numeric entry keys).
- Flipping the value (incrementing / decrementing using the up / down selection keys).

Numeric entry field rules

The entry field for voltage and current values has a fixed format: 4 value digits and a decimal point.

The position of the decimal point in the entry field is derived from the power module ratings, as shown bellow:

Power module rating	Format of entry field
1.250 or 2.500 or 5.000 or 8.000	n.nnn
10.00 or 18.00 or 20.00 or 36.00 or 40.00 or 80.00	nn.nn
160.0	nnn.n

To enter a numeric value, the cursor may be under any of the current value's digits.

Entering a numeric value

A numeric value may be entered, in a voltage or current entry field, using the numeric entry keys: 0 to 9, "." (decimal point) and DEL.

When you enter a numeric value implicit or explicit decimal point may be used to format the entered value.

Numeric value entry is finished implicitly (when the entry field is filled) or explicitly (using the left or right selection keys, the ENTER key or the SET key).

	Key pressed	Operation	Example
Start	Move into entry field.	The cursor is under the left most digit of the value displayed in the entry field.	"36.00"
First Key pressed	First key pressed – a digit.	The current value is cleared, the digit is placed at the left most position and the cursor moves to the right.	"36.00" ➔ "1_. "
	First key pressed – decimal point.	The entry field is filled with zeros to the left of the decimal point and the cursor is placed immediately to the right of the decimal point.	"36.00" ➔ "00._ "
	First key pressed – DEL.	The entry field is cleared and the cursor is placed under the left most position.	"36.00" ➔ "_ . "

	Key pressed	Operation	Example
Entry and Edit	More digits.	As each digit is pressed, the digit is added to the entry field and the cursor moves to the right. When all the digits to the left of the decimal point are entered, an implicit decimal point is added.	"1_. " ➔ "10._ " "10._ " ➔ "10.2_"
	Decimal point key is pressed.	The entered number is aligned with the decimal point and leading zeroes are added (if needed).	"1_. " ➔ "01._ "
	Del key is pressed.	The digit to the left of the cursor position is deleted and the cursor moves to the left.	"01._ " ➔ "0_. "
	Del key is pressed as many times as there are digits.	The entry field is cleared and the cursor is placed at the left most position..	"1_. " ➔ "_ . "
When field cleared	ENTER key is pressed when entry field is cleared.	The original entry field's value is restored and the value is accepted (the cursor moves to the next field).	"_ . " ➔ "36.00"
	Left or right selection key is pressed when entry field is cleared.	A value of zero is entered and accepted (the cursor moves to the previous or next field).	"_ . " ➔ "00.00"
End of value entry	Digits are entered until field is filled.	The value is accepted and the cursor moves to the next field.	"10.2_" ➔ "10.25"
	ENTER key is pressed.	The value is aligned in the field with leading and trailing zeroes added. The value is accepted and the cursor moves to the next field.	"10.2_" ➔ "10.20"
	Left or right selection key is pressed.	The value is aligned in the field with leading and trailing zeroes added. The value is accepted and the cursor moves to the next (right selection key) or previous (left selection key) field.	"10.2_" ➔ "10.20"
	SET key is pressed.	The value is aligned in the field with leading and trailing zeroes added. The value is accepted and programming mode is ended (the cursor returns to the lower row of the display).	"10.2_" ➔ "10.20"

Flipping the value

The second method of changing a voltage or current numeric value is to flip (increment / decrement) it using the up / down selection keys.

The amount the value is incremented or decremented each time a flip key is pressed depends on the digit the cursor is under.

Use the left / right selection keys to place the cursor under the digit representing the amount of change you wish to use for the flip operation, as illustrated below:

Effect of flip up (increment)	Effect of flip down (decrement)
"12.50" ➔ "22.50"	"12.50" ➔ "02.50"
"12.50" ➔ "13.50" "19.50" ➔ "20.50"	"12.50" ➔ "11.50" "10.50" ➔ "09.50"
"12.50" ➔ "12.60" "12.90" ➔ "13.00"	"12.50" ➔ "12.40" "12.00" ➔ "11.90"
"12.50" ➔ "12.51" "19.99" ➔ "20.00"	"12.50" ➔ "12.49" "10.00" ➔ "09.99"

Holding down the flip key (keeping an up or down selection key pressed) for more than a second invokes the key repeat operation: the key function is repeated at a rate of 10 times per second.

> The flip operation changes the value as each flip is performed – you do not need to confirm the new value for it to be accepted.

To move the cursor to another entry field or value to select, use the left / right selection keys or the ENTER key.

Press the SET key to exit programming mode.

Selecting other parameter values

Parameter values, other than voltage or current, have discrete values. To set a value for such a parameter use the UP / DOWN selection keys to select it from the list of available values (vertically browsing through available values).

Controlling the Power module's output

For instructions on how to program the power module's output voltage, current limit and on/off state please refer to the "First operation steps" chapter.

Setting programming limits

As mentioned before, each of the XMP 2600 power modules has a maximum allowed value for its output settings (voltage and current). The default upper limit values for the output settings are the power module's ratings.

However, some times you may wish to limit the output settings allowed values to protect sensitive loads that will not tolerate the full output ratings.

For that end you use the limit parameter (Vlim and Ilim): the values you program for the limit parameter are used as upper limits when you program output settings.

To set values for the limit parameter, proceed as follows:

- Select the power module to program (see: first operation steps chapter for details).
- Select the LIM parameter (use the up / down selection keys) and enter programming mode (press the SET key) or enter programming mode and then select the LIM parameter (see: Programming power module parameters at the beginning of this chapter).
- Set voltage and current values for the limit parameter (see: Programming power module parameters at the beginning of this chapter).
- Proceed to program other power module parameters or exit programming mode by pressing the SET key.

Setting protection thresholds

To protect the connected load from excessive output voltage or current delivery by the power module that feeds it, protection mechanisms are continuously monitoring the module's output voltage and current.

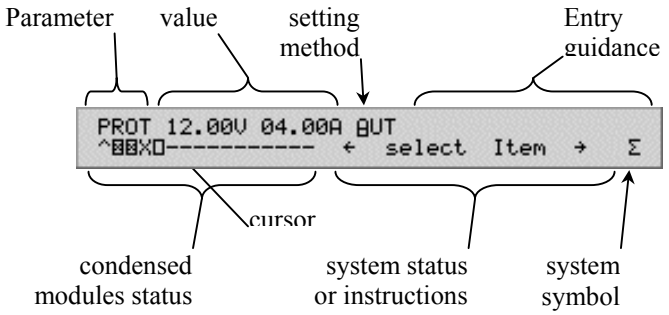
When the output's voltage or current exceed a pre-defined level a fault event is generated and the power module shuts down.

If the power module's control circuit ascertains that the module cannot shut down its output the XMP's main controller is informed and the main converter is shut down.

Protection thresholds are set using the PROT parameter.

Protection parameter display

When viewing (in status mode) or programming the protection parameter, the operating mode and foldback selection indicators that are usually shown on the display's upper row are replaced with an indicator of protection threshold setting method, as illustrated below.



Display in programming mode showing PROT values

Selecting the protection setting method

The protection threshold values can be set using one of two methods:

Manual .....the values for the protection thresholds are programmed by the user.

Automatic (or tracking) ..the values for the protection thresholds are automatically being set by the XMP each time new output settings are being programmed.

To select the preferred protection setting method proceed as follows:

- Select the power module to program (see: first operation steps chapter for details).
- Select the PROT parameter and enter programming mode (press the SET key) or enter programming mode and then select the PROT parameter (see: Programming power module parameters at the beginning of this chapter).
- If you have selected the PROT parameter in programming mode: press the left selection key (←) to move the cursor to the protection setting method selection field.
- If you have selected the PROT parameter in status mode, when you enter programming mode the cursor position depends on the currently selected method for setting the protection thresholds:
  - If the current method is automatic (shown as "AUT") – the cursor is placed under the method selection.
  - If the current method is manual (shown as "MAN") – the cursor is placed under the over voltage threshold entry field. In this case you need to press ENTER twice to move the cursor to the method selection field.
- Use the up / down selection keys to select the desired protection setting method.

How values are set using the automatic method

When using the automatic method for setting protection threshold values, whenever a new output setting value is programmed the XMP re-calculates the appropriate protection threshold value.

The calculation is based on a percentage of the setting programmed value plus a constant that depends on the power module's rating. The addition of a constant comes to solve situations where the calculated value is too close to the output setting value and false protection events may occur. For example: if a module with output rating of 60V is programmed to produce 1V a protection threshold of 1.1V is too low.

The following table details the way a protection threshold value is calculated for the different power module ratings:

Power module rating	Calculation of protection threshold value
1.250 or 2.500 or 5.000 or 8.000	SET + 10% + 1 Limited to V/Imax + 10%
10.00 or 18.00 or 20.00 or 36.00 or 40.00 or 80.00	SET + 10% + 1.5 Limited to V/Imax + 10%
160.0	SET + 10% + 5 Limited to V/Imax + 10%

Setting protection thresholds manually

To manually control the protection threshold settings you need to make sure the setting method is set to manual (shown as "MAN"). See: Selecting the protection setting method, above, if you need to change the setting method.

Once the setting method is set to manual, you can program the voltage (OVP) and current (OCP) protection thresholds the same way you program any other voltage or current parameter value. See: Programming power module parameters at the beginning of this chapter

> OVP and OCP thresholds must be set above the corresponding Vset and Iset values.

Selecting a current limiting scheme

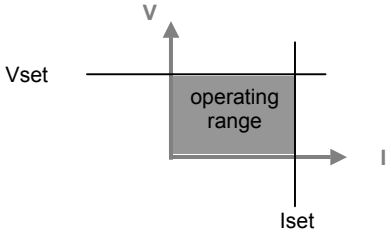
The XMP 2600 Power Modules have five different output current limiting schemes. The output current limiting scheme is selected when programming output settings using the SET parameter.

Available current limiting schemes

The five current limiting schemes, divided into four categories, are explained in the following sections.

Voltage / current mode

This output current limiting scheme instructs the Power Module to operate as either a voltage source or a current source with automatic switching between the two modes of operation.



This, default mode, is the most commonly used output current limiting scheme. The window workpoint warning feature can be used in combination with this output current limiting scheme to give you a more tight control over the load's behavior.

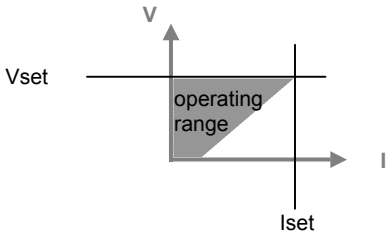
Foldback

Foldback is an output current limiting scheme in which both output voltage and output current are reduced when the Power Module is operating as a current source (current limitation is active).

There are two types of output foldback to choose from: linear and non-linear.

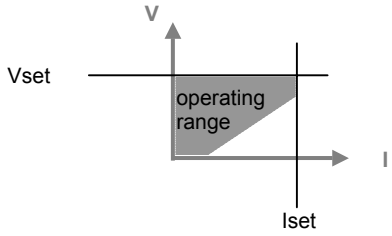
Linear foldback

When the linear output foldback mode of operation is selected, as the output current of the Power Module reaches its limiting value, output voltage and output current are reduced (depending on the characteristics of the connected load) down to 0 volts and 30% of the set current (for an output short-circuit).



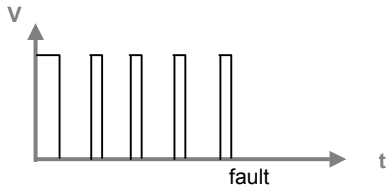
Non-linear foldback

When the non-linear output foldback mode of operation is selected, as the output current of the Power Module reaches its limiting value, the output voltage drops but the output current is held at its limiting value (depending on the characteristics of the connected load). This continues until output voltage has dropped down to 70% of the set value. From that point on, both the output voltage and output current are reduced (depending on the characteristics of the connected load) down to 0 volts and 30% of the set current (for an output short-circuit).



Retry

When the retry current limiting mode of operation is selected, the output of the Power Module will shutdown for 3 seconds as the output current reaches its limiting value. Following the 3 seconds off period, the output of the Power Module will be reactivated. If during the next second the output current is still at its limiting value, the output will be shutdown again. This process is repeated 5 times. After the fifth consecutive shutdown, the output of the Power Module remains shut and a fault event is generated.



This operating mode is useful when the connected load can be reset (and thus the cause of the excessive current eliminated) by removing the power that feeds it.

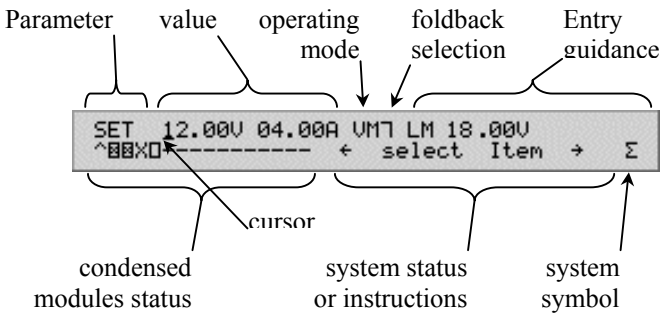
Shutdown on current limit

This mode of output current limiting is suitable for very sensitive loads. When this operating mode is selected, the output of the Power Module is shutdown as soon as the output current reaches its limiting value.

This type of current limit event is treated as a fault instead of a warning.

What is displayed

When programming output settings for a power module, the display will be similar to the illustration below:



Display in programming mode showing SET values

The foldback selection symbol represents the selected current limiting scheme as summarized in the following table:

Foldback symbol	Meaning of symbol
	No foldback … the power module's output changes from a voltage source to a current source depending on the connected load (constant voltage or constant current).
	Linear foldback ... when current limit is reached, the power module's output voltage decreases (down to 0) as does the output current (down to 30% of the current SET value).
	Non-linear foldback … when current limit is reached, the power module's output voltage decreases (down to 70% of the voltage SET value) while the output current stays constant. Beyond that point, the output current decreases as well (down to 30% of the current SET value).
	Retry …… when current limit is reached, the Power Module shuts-down it's output for a period of 3 seconds. Then, the output is restored for 1 second and if the current limit is still valid the cycle repeats itself. Up to 5 retries are performed until the Power Module declares an error condition and its output stays shut.
	Shutdown … when current limit is reached the power module shuts down and a fault is generated.

How to select

To select the desired current limiting scheme, proceed as follows:

- Select the power module to program (see: first operation steps chapter for details).
- Select the OUT, LOAD or SET parameter (use the up / down selection keys) and enter programming mode (press the SET key) or enter programming mode and then select the SET parameter (see: Programming power module parameters at the beginning of this chapter).
- Skip over the voltage and current entry fields by pressing ENTER, twice.
- Use the UP / DOWN selection keys to select the desired current limiting scheme symbol (see above).
- Proceed to program other power module parameters or exit programming mode by pressing the SET key.

Operating the power module relays

Each XMP power module has two output control relays: output disconnect and output polarity (these relays may, optionally, be omitted by the manufacturer at the user's request).

Output disconnect relay

To change the state of the output disconnect relay (open / close) proceed as follows:

- Select the power module to program (see: first operation steps chapter for details).
- Enter programming mode (press the SET key).
- Press the SYSTEM key to change the state of the output disconnect relay.
- Proceed to program other power module parameters or exit programming mode by pressing the SET key.

Output polarity

To change the power module's output polarity proceed as follows:

- Select the power module to program (see: first operation steps chapter for details).
- Select the OUT, LOAD or SET parameter (use the up / down selection keys) and enter programming mode (press the SET key) or enter programming mode and then select the SET parameter (see: Programming power module parameters at the beginning of this chapter).
- Press the CH key to change the output's polarity. Observe the sign of the voltage setting on the display.
- Proceed to program other power module parameters or exit programming mode by pressing the SET key.

> When a power module's output polarity is negative, a minus sign precedes the OUT, LOAD and SET voltage displayed values.

Globally enable/disable power module outputs

Turning on a specific power module is not sufficient for enabling its output.

In addition to controlling the state of the individual power module's output, the XMP 2600 has a global output enable/disable feature (global on).

Global on

When operating in status mode, the OUT key toggles the state of the global enable feature (global on/off).

> Global output enable will not turn on power modules whose outputs are individually turned off.

Global off

When operating in any mode other than power module programming, when the outputs of the power supply are globally enabled, you can press the OUT key to disable the outputs of all the power modules (global off). This feature will even work when the power supply is being remotely controlled.

Global on/off indicator

You can verify the state of the global enable feature by looking at the out indicator located next to the OUT key: when the indicator is on – outputs are globally enabled.

Clearing faults

The XMP 2600 has two categories of faults: power module faults and power system faults.

Clearing power module faults

To clear power module faults (e.g. OVP, OCP etc.), proceed as follows:

- Select the power module with the fault, in status display mode.
- Press the RESET key.

Clearing power system faults

To clear power system faults (e.g. module caused shutdown), proceed as follows:

- Move the cursor to the system symbol, in status mode.
- Press the RESET key.

Depending on the type of fault that you are trying to reset, the XMP 2600 main controller may find it necessary to perform a full reset.

Power supply reset

To reset the entire power supply system, press and hold down the DEL key , then (within 1 Second) while holding the DEL key pressed, press the LOCAL key - the two keys must be pressed together.

This will reset the entire Power Supply, returning it to its power on state.

The front panel reset operation can be executed any time regardless of the operating state the Power Supply is in.

7 Advanced features

This chapter covers advanced features offered by the XMP 2600 power system and explains the way to utilize them while operating the power supply from its front panel.

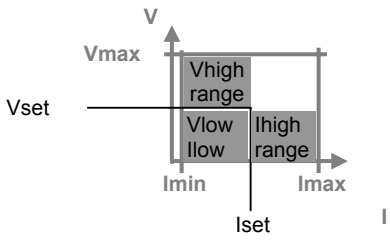
> Some advanced features are only available when a remote controller is controlling the power supply.

Work point window warning

In some applications it is desirable to know when a connected load requirements for power exceed a pre-defined V-I range.

To facilitate in notifying the user of such occurrences, the XMP 2600 power supply system offers the work point window warning feature.

The work point window warning feature allows the user of the XMP 2600 power supply system to define high and low voltage and current thresholds (above and below the output settings).



When the operating conditions of the connected load exceed any of the enabled window thresholds – a warning event is generated.

When a warning event is generated, the condensed status symbol of the power module starts blinking, as does the alarm indicator. The blinking of the status symbol continues until either the user selects the power module in status mode or the condition that caused the warning is removed.

Involved parameters

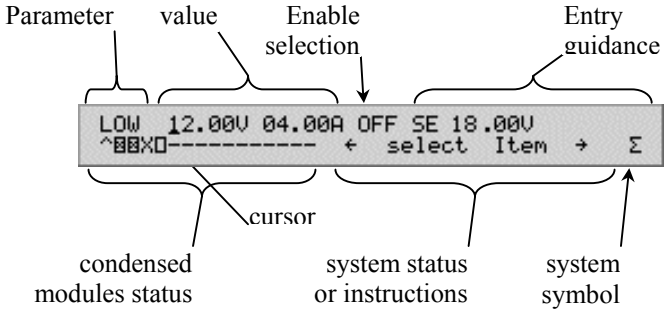
The work point window feature is set-up using two parameters:

- HIGH work point window thresholds (Vhigh and Ihigh) and enable.
- LOW work point window thresholds (Vlow and Ilow) and enable.

> HIGH and LOW work window thresholds can be enabled independently of each other.

What is displayed

The following illustration shows the display for the low work point window parameter. The display for the high work point window parameter is similar.



Display in programming mode showing LOW values

The display is similar to other displays with voltage and current entry fields with the exception of the enable selection: ON or OFF.

How to program window thresholds

To program the HIGH or LOW parameters proceed as follows:

- Select the power module to program (see: first operation steps chapter for details).
- Select the HIGH or LOW parameter (use the up / down selection keys) and enter programming mode (press the SET key) or enter programming mode and then select the HIGH or LOW parameter (see: Programming power module parameters in the basic operation chapter).
- Enter the desired Vhigh or Vlow threshold value or skip the voltage entry field by pressing the ENTER key.
- Enter the desired Ihigh or Ilow threshold value or skip the current entry field by pressing the ENTER key.
- Use the UP / DOWN selection keys to enable (ON) or disable (OFF) the voltage and current HIGH or LOW window thresholds.
- Proceed to program other power module parameters or exit programming mode by pressing the SET key.

Simulated ripple

Power modules of the XMP 2600 power system can generate simulated ripple at their outputs.

The amount of ripple that will be added to the output voltage depends on many variables such as output capacitance, connected load, programmed voltage and current etc. Therefore an exact voltage span for the simulated ripple cannot be specify, only a low or high level.

To program a simulated ripple for a power module's output proceed as follows:

- Select the power module to program (see: first operation steps chapter for details).

- Select the RIPL parameter (use the up / down selection keys) and enter programming mode (press the SET key) or enter programming mode and then select the RIPL parameter (see: Programming power module parameters in the basic operation chapter).
- Useing the UP / DOWN selection keys, select the amount of ripple:
  - OFF – no ripple at all.
  - LOW.
  - HIGH.
- If the simulated ripple was not disabled (a displayed level selection of OFF), you may select a frequency:
  - Move the cursor to the frequency selection using the RIGHT selection key or the ENTER key.
  - Using the UP / DOWN selection keys, select a frequency for the ripple: 50Hz, 60Hz, 100Hz, 120Hz, 400Hz, 800Hz or 2KHz.
- Proceed to program other power module parameters or exit programming mode by pressing the SET key.

Arm, trigger and sync

The arm, trigger and sync mechanisms allow for synchronization of internal power module operations to external events.

Arming a power module

The arm mechanism enables to defer changes in output settings.

The arm mechanism

To ARM a Power Module means to instruct the Power Module to store new output settings values (Vset, Iset, OVset, OCset and polarity) for future use without modifying its output.

When a Power Module is armed, new output settings values are stored and do not change the state of the Power Module's output.

The stored values are used by the trigger mechanism in several of its operating modes, as described later on.

Any other output control operations for an armed Power Module (e.g. output on/off, disconnect relays open/close, etc.) will un-arm the Power Module and use the stored Vset and Iset values when updating its output. Any stored polarity change is ignored.

How to ARM a power module

To arm a power module proceed as follows:

- Select the power module to program (see: first operation steps chapter for details).
- Select the LOAD, OUT or SET parameter (use the up / down selection keys) and enter programming mode (press the SET key) or enter programming mode and then select the SET parameter (see: Programming power module parameters in the basic operation chapter).
- Press the STO key.
- Proceed to program other power module parameters or exit programming mode by pressing the SET key.

When the display shows module detailed status and no fault or warning events are reported, the status will reflect the armed state of the power module.

Responding to a trigger event

Power modules of the XMP 2600 power system can be programmed to respond to a trigger event.

The trigger mechanism

Every Power Module of the XMP 2600 can receive a trigger and perform a programmed action.

Trigger events can be supplied to the Power Modules using the hardware TRIG connector at the back of the XMP 2600 mainframe (applied simultaneously to all the Power Modules in the mainframe) or using a software command. You can use the XMP's front panel to supply software triggering to individual power modules.

Responses to a trigger event

The following table describes the various responses available to a trigger event:

Selected trigger response	Response to the trigger event
ARM values Step	When the trigger arrives, the power module will take the Vset, Iset OVset, OCset values and polarity state programmed while it was armed and use them to update the state of the Power Module's output. The power module is un-armed.
UN-ARM	A trigger will cause the power module to be un-armed and any value stored while it was armed is discarded.
No Operation	A trigger supplied to the Power Module is ignored. This is useful when you use the hardware trigger (supplied to all the power modules in the mainframe) and you do not want a power module to respond.
Channel Off	A trigger event will turn off the power module's output. If the output is already off when the trigger arrives, it will remain off.
Channel On	A trigger event will turn on the power module's output. If the output is already on when the trigger arrives, it will remain on.
RAMP I t=0:00:000	A trigger will initiate a current ramp in the power module's output with the programmed ramp duration (see output ramping, below).
RAMP V t=0:00:000	A trigger will initiate a voltage ramp in the power module's output with the programmed ramp duration (see output ramping, below).
Channel ON/OFF	A trigger event will toggle the state of the power module's output: ◆ If the output was on – it will be turned off. ◆ If the output was off – it will be turned on.

How to program the response to a trigger

To program the trigger response of a power module proceed as follows:

- Select the power module to program (see: first operation steps chapter for details).
- Select the TRIG parameter (use the up / down selection keys) and enter programming mode (press the SET key) or enter programming mode and then select the TRIG parameter (see: Programming power module parameters in the basic operation chapter).
- Use the UP / DOWN selection keys to select the desired trigger response for the power module.
- When the selected response to a trigger is to initiate a ramp (voltage or current) the TRIG parameter includes an entry field for the ramp's duration. See output ramping, below, for details.
- Proceed to program other power module parameters or exit programming mode by pressing the SET key.

Generating a trigger

Using the XMP's front panel you can generate a trigger event for a specific power module.

To generate a trigger event proceed as follows:

- Select the power module to program (see: first operation steps chapter for details).
- Select the LOAD, OUT or SET parameter (use the up / down selection keys) and enter programming mode (press the SET key) or enter programming mode and then select the SET parameter (see: Programming power module parameters in the basic operation chapter).
- Press the RCL key. The power module being programmed will respond with the selected trigger response.
- Exit programming mode by pressing the SET key.

The SYNC output

Each of the XMP's Power Modules can generate a hardware signal (SYNC) when certain internal events occur. The SYNC signals from all the Power Modules housed in the mainframe are summed (OR'ed) to produce the SYNC output pulse available at the XMP's back panel.

You can use the SYNC signal to synchronize external hardware to events occurring in the XMP's power modules.

The SYNC output is a digital signal with TTL levels. Its normal state is '1' and the pulse changes its level to '0' for a period of 0.5mS.

Available selections for events that generate a SYNC

A Power Module can generate a SYNC when one of the following occurs:

Selected event	When is the SYNC signal generated
Output Settle	A SYNC is produced when the output of the Power Module settles to within 2% of Vmax or Imax from the programmed Vset or Iset. A new SYNC signal is generated following any commanded change of the Power Module's output, be it a new Vset or Iset value, a ramp operation or an output on/off state change. You can use the SYNC signal to synchronize external hardware to changes in the Power Module's output.
No Operation	The power module will never generate a SYNC signal. Use this selection when you wish the SYNC output to be associated with a specific power module.
……	Not defined – reserved for future expansion.
new SET value	The Power Module generates a SYNC whenever a new Vset or Iset value is programmed (and NOT when the output actually changes). You can use the SYNC signal to synchronize external hardware to expected changes in the Power Module's output (an advanced trigger or "pre-trigger").
Trigger	The Power Module generates a SYNC whenever it receives a trigger (either hardware or software trigger). Using this SYNC generation mode enables the XMP 2600 to generate a hardware signal in response to a software event.

How to select the event that generate a SYNC

To select the event that will cause the power module to generate a SYNC proceed as follows:

- Select the power module to program (see: first operation steps chapter for details).
- Select the SYNC parameter (use the up / down selection keys) and enter programming mode (press the SET key) or enter programming mode and then select the SYNC parameter (see: Programming power module parameters in the basic operation chapter).
- Use the UP / DOWN selection keys to select the desired event that will cause the power module to generate a SYNC.
- Proceed to program other power module parameters or exit programming mode by pressing the SET key.

Output ramping

What is output ramping?

Output ramping is a feature of the XMP's Power Modules that enable them to produce a gradual linear smooth change in their output. The change in a Power Module's output can be either a voltage change or a current change.

A ramp can be either a down-ramp (negative slope) or an up-ramp (positive slope) but it cannot change the polarity of the Power Module's output.

Output ramping can be as fast as a single output step occurring within 6mS of initiation (limited by the module's rise/fall time) or it can be a gradual process lasting as long as 6 Minutes, 33 Seconds and 210 mili-seconds.

While ramping its output, the Power Module uses, for the ramp calculations, a resolution much higher than the output programming resolution. This fact ensures that no calculation-induced errors will affect the produced output ramp.

> Ramping must not be combined with any foldback mode other than "no foldback" (voltage/current operating mode).

Output ramping setup

To produce a ramp, the XMP 2600 needs to know the start value, the ramp's duration and the desired end value. Using these values, the XMP 2600 calculates the data needed for the Power Module to produce a precise up or down ramp.

When the parameters for the ramp operation are being programmed, the XMP 2600 needs to know it should calculate the data needed by the Power Module to generate the ramp. Therefore the ramp mode must be selected before the parameters for the ramp operation are being programmed.

The following sequence of operations demonstrates the proper way to program the XMP 2600 to produce a ramp:

- Set initial state.
- Select type of ramp and duration.
- Arm and set final state.

The same procedure can be used to produce a voltage up-ramp, voltage down-ramp or a current up or down ramp.

Set initial state

First of all you need to set the voltage and current the ramp operation will start from.

To set the initial state proceed as follows:

- Make sure outputs are globally enabled. If the ON indicator is extinguished, make sure the XMP is displaying status and press the OUT key to globally enable all the outputs.
- Select the power module to program (see: first operation steps chapter for details).
- Select the LOAD, OUT or SET parameter (use the up / down selection keys) and enter programming mode (press the SET key) or enter programming mode and then select the SET parameter (see: Programming power module parameters in the basic operation chapter).
- Program the power module for the initial voltage and current.
- Make sure that no foldback is selected.
- Turn the power module's output on by pressing the OUT key.

Select type of ramp and duration (trigger mechanism)

- Select the TRIG parameter (move the cursor to the parameter's name and use the up / down selection keys).

- Move the cursor to the trigger response selection (using the RIGHT selection key or the ENTER key) and select the response to be RAMP I or RAMP V (use the UP / DOWN selection keys).
- Move the cursor to the ramp duration entry field (use the RIGHT selection key or the ENTER key) and enter the desired duration (see below).

How to enter ramp duration

Ramp duration is programmed by flipping the value (incrementing / decrementing) using the UP / DOWN selection keys.

Place the cursor (using the RIGHT / LEFT selection keys) under the digit you wish to flip. The digit you select determines the amount added or subtracted from the duration as you flip it.

As you flip the ramp's duration you may notice that the duration is set in units of 6 mili-seconds, therefore the change in value will be a multiply of 6.

ARM and Set final state

Finally, prepare the power module for ramp initiation:

- Select the SET parameter (move the cursor to the parameter's name and use the up / down selection keys).
- Press the STO key to arm the power module.
- Move the cursor to the voltage or current entry field (use the RIGHT selection key or the ENTER key) – depending on the type of ramp you wish to initiate.
- Set the final value for the ramp operation. If the value you program is lower than the initial value, you will generate a down-ramp. If the value you program is higher than the initial value, you will generate an up-ramp.
- Press SET to exit programming mode or proceed to trigger the power module.

Output ramping initiation

Once the ramp operation is setup the Power Module is waiting for a trigger in order to start ramping its output.

The trigger can be supplied to the Power Module using one of the following methods:

- Hardware trigger – TRIG input at the rear panel.
- Manual Power Module trigger – using the front panel.

To trigger the power module using the front panel proceed as follows:

- If you are no longer in programming mode:
  - Select the power module to program (see: first operation steps chapter for details).
  - Select the LOAD, OUT or SET parameter (use the up / down selection keys) and enter programming mode (press the SET key) or enter programming mode and then select the SET parameter (see: Programming power module parameters in the basic operation chapter).
- Press the RCL key. A trigger is generated and the ramp operation commences.

- Exit programming mode by pressing the SET key.

> If the event to generate a SYNC was selected to be "Output settle" then the XMP will produce a SYNC signal when the ramp operation is done.

Synchronization of operations

The synchronization features of the XMP 2600 enable it to perform various simultaneous or sequential operations with very tight timing.

Some of the synchronization capabilities are only available when using a remote controller (please refer to the programming manual for further details).

This section will cover only the synchronization of operations that can be achieved when operating the power supply from its front panel.

Simultaneous operations

The XMP 2600 provides synchronization mechanisms that enable you to command simultaneous changes in the outputs of several Power Modules.

Output on/off

To turn on or off a group of Power Modules (or all of them) at the same time, follow this procedure:

- Turn on (enable) the Power Modules you wish to use (individually, using the OUT key while programming their SET parameters).
- Use the global output enable feature to turn all enabled the outputs on or off (press the OUT key while in status mode).

Other operations

If you wish to command a group of Power Modules (or all of them) to perform a simultaneous change in their output, you can use the trigger mechanism (described above).

Using the trigger mechanism (and the arming of modules, when necessary), you can program several Power Modules to react to an incoming hardware trigger.

This feature enables you to simultaneously command Power Modules to perform one of the following operations:

- Change Power Modules output settings (voltage and/or current).
- Change Power Modules output state (on/off).
- Initiate Power Modules output ramping.

Note that the Power Modules do not need to perform the same operation in reaction to the trigger. You may program some of them to change their output settings while others are turned on or off or start ramping.

> If you have no means of providing a hardware trigger you may use the SYNC signal to generate the trigger. Connect the SYNC output to the TRIG input and program a power module to generate a SYNC. Then, cause a change in the programmed power module so it will generate a SYNC (see Sequential operations).

Sequential operations

Most of the lengthy operations of the XMP 2600 are carried out by the Power Modules (output changes, ramping etc.). This means that those lengthy operations can be (and usually are) overlapped in their execution. More often than not this is an advantage, but sometimes you may wish to serialize (sequentially perform) such operations (e.g. change the output of module No.2 after module No. 1 has finished ramping).

You can use the hardware signals TRIG and SYNC to serialize operations.

As mentioned before, a Power Module can generate a SYNC signal when its output change is done. Feeding the SYNC signal into the TRIG input enables other Power Modules to react to the aforementioned Power Module's end of operation, thus achieving operations serialization.

To use this mechanism, proceed as follows:

1. Program all the Power Modules, but the one you wish to use, to never generate a SYNC.
2. Program the Power Module that will perform the first operation to generate a SYNC on output settle.
3. Program the Power Modules that are going to perform the second operation to react to a trigger. Use the ARM mechanism if necessary.
4. Program all the other Power Modules to ignore the trigger.
5. Initiate the first operation.

When the first operation is complete, the Power Module that performs it will generate a SYNC. This SYNC signal will, in turn, generate a trigger to the other Power Modules causing them to initiate the second operation.

Store and Recall

The XMP 2600 has ten storage areas each capable of holding the values of all the parameters of all the power modules. Using these storage areas you can save a complete "state" of the power supply system and restore it later.

The stored data is kept in a battery backed up RAM and is not cleared by resetting the power supply or cycling its power.

Storing a state

To store a power supply state proceed as follows:

- Make sure the display is in status mode.
- Move the cursor to a condensed status symbol of any power module (use the LEFT / RIGHT selection keys).
- Press the STO key. An input field opens at the display's lower row, in the system message area ("STORE into #"), ready for you to specify a storage number.
- Press a digit key (0 to 9) to specify a storage number. A confirmation question ("OK?") is displayed. If the storage area already has data stored in it, a message ("NOT FREE") is displayed on the upper row of the display.
- To finish the operation, do one of the following:
  - Confirm the store operation by pressing the ENTER key.
  - Cancel the store operation by pressing the DEL key.

Restoring a state

To recall a stored power supply state proceed as follows:

- Make sure the display is in status mode.
- Move the cursor to a condensed status symbol of any power module (use the LEFT / RIGHT selection keys).
- Press the RCL key. An input field opens at the display's lower row, in the system message area ("RECALL from #"), ready for you to specify a storage number.
- Press a digit key (0 to 9) to specify a storage number. A confirmation question ("OK?") is displayed. If the storage area has no data stored in it, a message ("NO DATA") is displayed on the upper row of the display.
- To finish the operation, do one of the following:
  - Confirm the recall operation by pressing the ENTER key.
    - If the store area is empty, the operation is ignored.
    - If the storage area is not empty, all the power modules are reprogrammed with the stores data.
  - Cancel the recall operation by pressing the DEL key.

> The store and recall operations pertain to the reprogramming delay as well (see the power supply setup chapter).

Shutdown grouping

XMP Power Modules are shutdown when they detect a fault. Since the XMP 2600 is mostly used in systems where several outputs feed the same load it is often desirable to have other Power Modules shutdown together with the faulty one.

The XMP 2600 provide its user with several methods of controlling Power Modules shutdown behavior, most of them available only when using a remote controller. The following text describes one of the ways to control shutdown behavior of Power Modules: shutdown grouping. This feature is available when using the XMP's front panel to control it.

The different shutdown grouping of modules

Each XMP 2600 Power Module has a programmable parameter that tells the XMP 2600 how to handle the fact that the power module is being shutdown due to a fault. The aforementioned parameter can have the value single, group or global.

Single module shutdown

When a Power Module is defined as "single shutdown", when it is being shutdown due to a fault, no other Power Modules are shutdown along with it.

Group shutdown

When a Power Module that is shutdown due to a fault is defined as "group shutdown", all other Power Modules that have the "group shutdown" definition are shutdown along with it.

Global shutdown

When a Power Module that is shutdown due to a fault is defined as "global shutdown", all the Power Modules are shutdown along with it.

Selecting shutdown grouping

Shutdown grouping is selected in setup mode along with the definition of internal (to the master mainframe) and external modules.

For instructions on how to select shutdown grouping for each power module, please refer to the power supply setup chapter.

8 Sequence programming

Sequence programming is a feature of the XMP 2600 that enables it to automatically change states and create dynamic outputs without the use of a remote controller.

Sequence program capabilities

The sequence program feature has the following capabilities:

- A sequence program is made out of steps, each capable of introducing a delay and performing an operation.
- The sequence program can have up to 99 steps.
- The delay a step can introduce may be as long as 9 Hours, 59 Minutes and 59 Seconds and is specified with a resolution of a second.
- The sequence program state changes are mostly based on the 10 storage areas that were discussed in the previous chapter (see: store and recall).
- A "simple" step executes within 0.1 second. For recall steps, add about 0.2 second for each installed power module.
- While running, the user can monitor and control the execution of the sequence program.

Preparing the sequence program

The sequence program is prepared in the sequence program editing mode but some preparations should be made before starting program editing.

Prepare the states used by the program

The sequence program uses pre-created states to produce its state changes.

To create a state to be used by the sequence program proceed as follows:

- Program all the power modules to create the outputs and conditions you want a state to have.
- Store the state you have created in one of the ten storage areas.

> You do not need to create a state where all the outputs are off because the sequence program itself can do this.

Repeat the above steps to create all the states you are going to have in the sequence program.

Enter program editing mode

To enter sequence program editing mode proceed as follows:

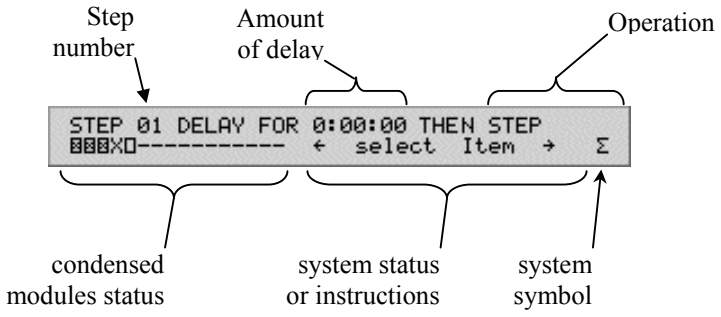
- Move the cursor to the system symbol ("Σ") and make sure the power supply is displaying global system status. Use the table below as a guide on how to get there.

IF…	Take the action…
Operating in programming mode (an underline cursor is visible at the upper row of the display)	Press the SET key to exit programming mode and press the SYSTEM key to move the cursor to the system symbol.
The cursor is not at the system symbol ("Σ")	Method 1: Press the SYSTEM key to move the cursor to the system symbol. Method 2: if the cursor (blinking black rectangle) is at the lower row of the display you can use the selection keys ← → to move the cursor to the system symbol.
The cursor is at the system symbol but the upper row shows other information.	Press the SYSTEM key, examine the information on the upper row of the display and act accordingly.
The cursor is at the system symbol but the upper row reads: "Power Supply Set Up"	Press the SET key to exit the setup mode and return to status mode.
You are unable to get the display you want using the instructions above.	Reset the power supply: Method 1: Press and hold the DEL key and then press LOCAL - the two keys must be pressed together. Method 2: recycle power using the line switch.

- Press the STO key to enter sequence program editing mode.

What is displayed

The following illustration shows the basic display while you edit the sequence program.



Display in sequence program editing mode

Display details

When you edit the sequence program, the cursor (appearing as a blinking black rectangle) is located at the upper row of the display pointing out the selected field.

The fields that make up a step display are explained below.

Step number

This is the number of the step being edited. To move to another step you simply change the shown step number.

Amount of delay

The amount of delay the step will introduce when the sequence program is running. The format of the displayed delay amount is: H:MM:SS (H=hours , MM=minutes , SS=seconds).

The step's operation is performed after the delay period is over.

Operation

The operation the step being edited is to perform after the delay period is over.

This field does not have a fixed format – its appearance is changed depending on the selected operation.

How to clear the whole program

To clear the entire sequence program, press the ENTER key.

The upper row of the display will show a confirmation request: "PRESS ENTER TO DELETE ALL STEPS":

- To confirm the clear operation: press the ENTER key.
- To abort the clear operation: press the DEL key.

Create / Edit a step

To create / edit the sequence program, edit its individual steps.

To edit a step to select it first, then modify the amount of delay it will introduce and select the operation it will perform.

Selecting a field

To select the field to edit, move the cursor so it points to the desired field. Use the following guidelines for moving the cursor:

- Press the ENTER key to move the cursor to the next field (move right). The cursor moves in a cyclic manner.
- Use the RIGHT and LEFT selection keys to move the cursor:
  - For selection fields the cursor moves from field to field.
  - For fields with a numeric value the cursor moves one digit at a time.

Select the step to edit

There are two methods for selecting the step to edit (changing the displayed step number):

- Use the UP and DOWN selection keys to flip the step number. The flip operation can be performed on any of the two displayed digits:

Effect of flip up (increment)	Effect of flip down (decrement)
"12" ➔ "22"	"12" ➔ "02"
"12" ➔ "13" "19" ➔ "20"	"12" ➔ "11" "10" ➔ "09"

- Enter a step number using the numeric entry keys:
  - Press a single digit and confirm by pressing ENTER.

    OR
  - Enter a two-digit number.

Clearing the selected step

To clear a step's amount of delay to zero and select the default operation, proceed as follows:

- Move the cursor to the step's number.
- Press the DEL key.

> The default operation of a step is :STEP, i.e. go-to to next step (this step will just introduce a delay).

Set the amount of delay

Move the cursor to point to one of the digits of the amount of delay, and proceed to use one of the following courses of action:

Clear the delay

To clear the delay (set it to zero) press the DEL key.

Enter a numeric value

Use the numeric entry keys to enter a value in units of seconds.

Use the following guidelines to help you with the numeric entry:

- Enter the value in seconds. If the entered value does not fill-up the field you will need to use the ENTER key to confirm the value. The confirmed value will be displayed in the format H:MM:SS.

  For example:..... Press the digit 3 three times and press enter to confirm a value of 333 seconds. The display of the confirmed value will be: 0:05:33.
- Use the Decimal Dot key to change the units of the digits entered so far.

  For example:..... Press 2.10.20 to enter the value 2:10:20. For an entry with less than 5 digits, end the entry by pressing the ENTER key.

Flip the value

Use the UP / DOWN selection keys to flip (increment / decrement) the value shown for the amount of delay.

The flip operation is done with the units of the selected digit.

For example: .....for a displayed value of 3:02:14 with the cursor at the "0" (10's of minutes) a flip up changes the value to 3:12:14 (adding 10 minutes) and a flip down changes the value to 2:52:14 (subtracting 10 minutes).

Select an operation

Move the cursor to the operation field and select the desired operation, using the UP / DOWN selection keys.

The available operations are listed in the table, below.

Selected operation	Description and setting instructions
STEP	Go-to the next Step. This type of operation causes the step to introduce a delay and do nothing else. Stepping from step 99 causes the Sequence Program to end (when it is running).
RCL n	Recall a saved state (modules settings) from storage area n. When this operation is selected, an additional entry field is opened enabling the selection of the storage area to use. Move the cursor to the storage area number and select the storage area to use. To select the storage area number, usie the UP / DOWN selection keys (flipping) or press a digit to enter it directly. When the selected storage area is empty, a warning message appears at the display's lower row where system message are shown: "* RCL STORAGE EMPTY *".
GO nn	Go-to step nn. This operation changes the sequence of execution by causing step nn to be the next step to execute. Use this type of operation to create a loop. When this operation is selected, an additional entry field is opened enabling the selection of the step to go to. Move the cursor to the number of the step to go to and select it. Set the number of the Step to go to as described above for "Select the step to edit".
OFF	Globally disable all Power Modules outputs.
ON	Globally enable all Power Module outputs. Note that only power modules that are specifically turned on will provide output.
STOP	Stop execution of the Sequence Program.

Exit sequence program editing mode

Press the SET key to exit sequence program editing mode and return the Power Supply to status mode.

Running the sequence program

Activate the sequence program

To activate the sequence program proceed as follows:

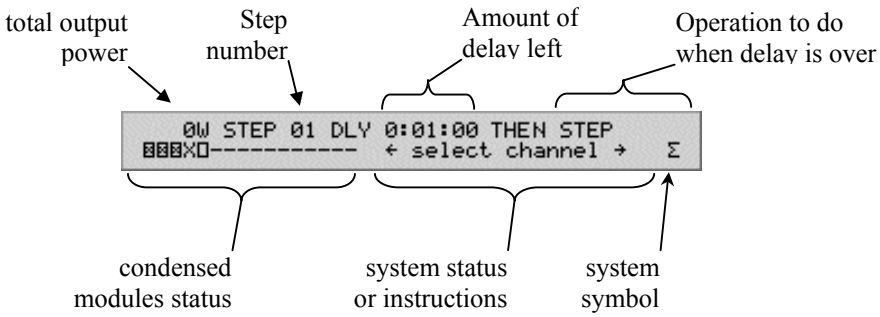
- Move the cursor to the system symbol ("Σ") and make sure the power supply is displaying global system status. Use the table below as a guide on how to get there.

IF…	Take the action…
Operating in programming mode (an underline cursor is visible at the upper row of the display)	Press the SET key to exit programming mode and press the SYSTEM key to move the cursor to the system symbol.
The cursor is not at the system symbol ("Σ")	Method 1: Press the SYSTEM key to move the cursor to the system symbol. Method 2: if the cursor (blinking black rectangle) is at the lower row of the display you can use the selection keys ← → to move the cursor to the system symbol.
The cursor is at the system symbol but the upper row shows other information.	Press the SYSTEM key, examine the information on the upper row of the display and act accordingly.
The cursor is at the system symbol but the upper row reads: "Power Supply Set Up"	Press the SET key to exit the setup mode and return to status mode.
You are unable to get the display you want using the instructions above.	Reset the power supply: Method 1: Press and hold the DEL key and then press LOCAL - the two keys must be pressed together. Method 2: recycle power using the line switch.

- Press the RCL key to initiate sequence program run mode.
- A confirmation message is displayed: "PRESS ENTER TO START PROGRAM".
  - Press ENTER to start execution of the sequence program.
  - Press any other key to abort.

Monitor sequence program execution

While the sequence program is running the global system status display changes, showing the sequence program progress of execution.



Global system status display during sequence program run mode

This modified global system status display is shown whenever the cursor is placed at the system symbol, in status mode, during sequence program execution.

Control sequence program execution

While the sequence program is running, you have some degree of control over its execution.

To be able to control the execution of the sequence program you need the display to show global system status (the modified version, showing sequence program execution progress as explained above).

Shorten the current delay period

Press the ENTER key to shorten the delay period of the currently active step.

The delay is shortened to zero and the step carries out its operation.

Stop the sequence program

To abort execution of the sequence program, press the RESET key.

> When execution of the sequence program ends, the XMP 2600 retains the last state set by the sequence program.

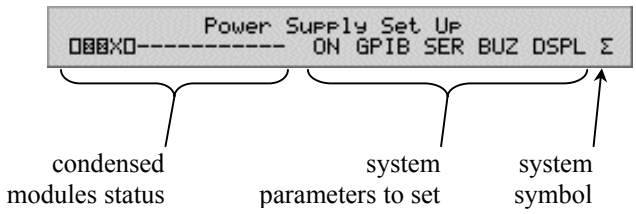
9 Power Supply setup

In the setup mode of operation you control system and communication links parameters. Some power module parameters are set using this mode of operation along with comprehensive power module testing and manual power module calibration functions.

Using the setup mode of operation you are able to view system's controller and power module's controller information, not available in the normal status views.

What is displayed

The following illustration shows the main display of the setup mode of operation.



Main display of system setup

How to get there

To enter the setup mode of operation proceed as follows:

- Make sure the display is in status mode.
- Move the cursor to the system symbol ("Σ") using the LEFT / RIGHT selection keys or the SYSTEM key.
- Press the SET key.

Display details

The upper row of the display indicates the operating mode in effect (setup).

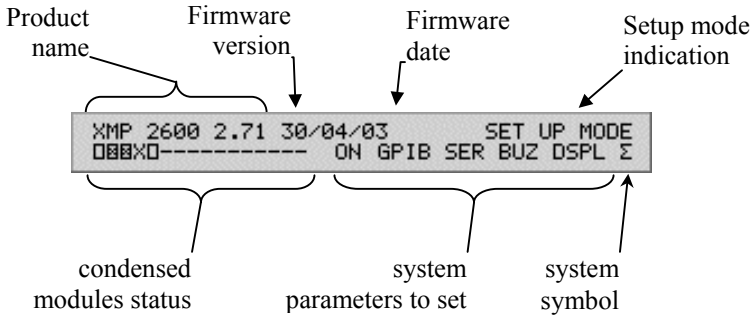
In addition to the already familiar power modules condensed status symbols, the lower row of the display shows a list of system parameters as summarized in the following table:

Parameter	Description
DSPL	Set the LCD contrast settings.
BUZ	Select the behavior of the internal buzzer (audible alarm).
SER	Temporary(1) activation of the RS232 serial communication link, selection of operating mode and setting of parameters.
GPIB	Temporary(1) activation of the GPIB communication link and setting of parameters.
ON	Select a state for the power-on retain flag.

(1) Following power-on or a full reset the RS232 and GPIB link activation state is restored from the dip switches located at the back of the unit.

Viewing system controller information

While the cursor is a the system symbol, press the RCL key to view firmware version and date, as illustrated bellow:



Setup mode display – system controller information

To clear the display, press the SYSTEM key or the LEFT / RIGHT selection keys.

Leaving setup mode

To leave the setup mode of operation proceed as follows:

- Move the cursor to the system symbol ("Σ") using the SYSTEM key.
- Press SET.

> The SYSTEM key will always move the cursor to the system symbol even when setting communication link parameters.

System parameters

When a system parameter is selected (the cursor is placed over its name) on the lower row of the display, the upper row shows the name of the parameter being controlled and its selected value.

Setting display contrast

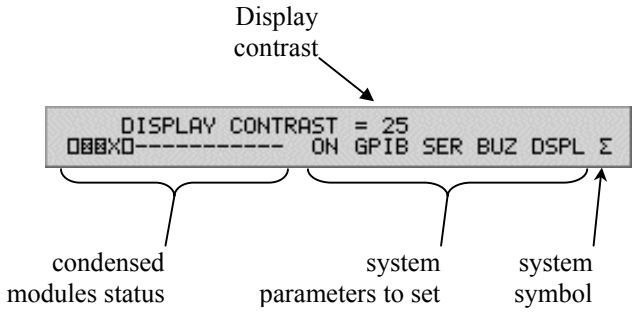
The contrast settings of the LCD display controls its readability in different viewing angles.

How to get there

Use the LEFT / RIGHT selection keys to move the cursor to the DSPL parameter.

What is displayed

The upper row of the display shows the name of the parameter being controlled and its selected value.



Setup mode display – display contrast

How to select a value

Use the UP / DOWN selection keys to select the desired LCD contrast value in the range 1 (minimum contrast) to 25 (maximum contrast).

Selecting buzzer behavior

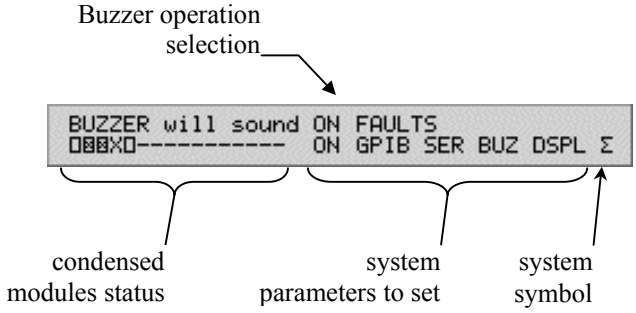
Use this parameter to control the system's audible alarm.

How to get there

Use the LEFT / RIGHT selection keys to move the cursor to the BUZ parameter.

What is displayed

The upper row of the display shows the selection for the audible alarm behavior.



Setup mode display – buzzer setup

How to select a value

Use the UP / DOWN selection keys to select the desired behavior for the buzzer, as detailed in the table below.

BUZZER will sound	Description
NEVER	The audible alarm is disabled.
ON FAULTS	The audible alarm will sound when a fault or warning event occurs. To silence the alarm, press any key.
ALWAYS	The audible alarm will sound when a fault or warning event occurs. To silence the alarm, press any key. A short beep will be heard when an illegal key is pressed or erroneous value entry is made.

Setting the power-on retain behavior

The power-on retain function controls whether the XMP 2600 power supply system will remember its last settings when power is cycled.

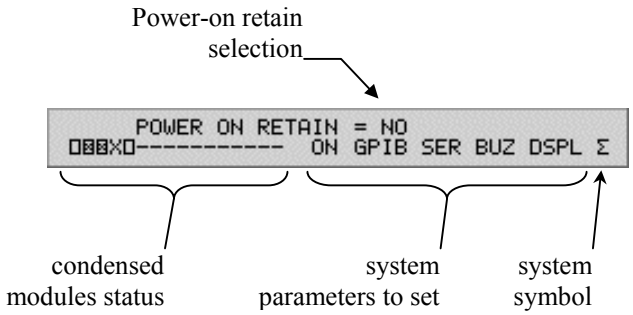
In addition to the ten storage areas at the users disposal, the XMP 2600 has a storage area dedicated to keeping the current settings of all the power modules and the state of the global output enable. The power-on retain mechanism uses that storage area.

How to get there

Use the LEFT / RIGHT selection keys to move the cursor to the ON parameter.

What is displayed

The upper row of the display shows the selected state of the power-on retain function.



Setup mode display – power-on retain selection

How to select a value

Use the UP / DOWN selection keys to select a value for the power on retain function:

POWER ON RETAIN	Description
YES	When power is turned on, the XMP 2600 uses the stored settings to automatically re-program all the power modules to their last settings (a retain operation).
NO	When power is turned on the XMP 2600 initializes the parameters of all the power modules: ◆ Vset=0, Iset=Imin, OUT=off ◆ PROT = auto, HIGH=off, LOW=off ◆ RIPL=off, LIM=max ◆ SYNC=output settle ◆ TRIG=arm values step The global output enable flag is also cleared.

Configuring the serial (RS232) link

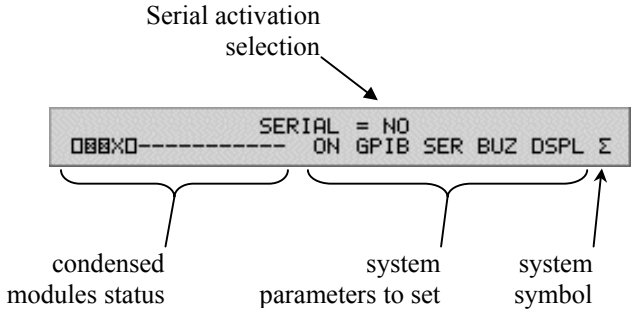
The RS232 serial communication link is used for either remotely controlling the XMP 2600 power supply system or getting a full screen remote activity monitor.

Activating the RS232 link

Activation of the RS232 serial communication link is done with the dip switches located at the back of the XMP's master mainframe but it can also be, temporarily, activated using the front panel.

What is displayed

The following illustration shows the way the RS232 serial communication link is activated (or disabled):



Setup mode display – serial link activation

How to, temporarily, activate (or disable) the RS232

To control the state of the RS232 serial link proceed as follows:

- Make sure the display is in setup mode.
- Move the cursor (using the LEFT / RIGHT selection keys) to the SER parameter.

- Using the UP / DOWN selection keys change the state of the RS232 serial link to one of the following:
  - "SERIAL = NO" to disable the RS232 serial communication link.
  - "SERIAL = YES" to activate the RS232 serial communication link. Selecting this state, automatically changes the display to the RS232 setup mode. If the GPIB link is also active, the RS232 serial link will be set to the monitor mode of operation.

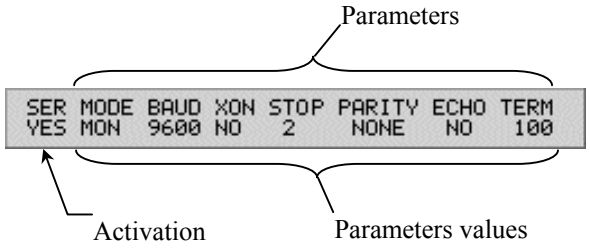
Setting RS232 parameters

When the RS232 serial link is active, its mode of operation is automatically set to monitor when the GPIB link is also active (being used for remotely controlling the XMP power supply system).

All other RS232 parameters (including the operating mode when the GPIB link is disabled) are set using the front panel.

What is displayed

The following illustration shows the display layout when setting up the RS232 serial link parameters:



Setup mode display – serial link setup

The upper row of the display is showing the parameter names while the lower row displays the current values of the parameters.

How to get there

To enter the RS232 serial communication link setup proceed as follows:

- Make sure the display is in setup mode.
- Move the cursor (using the LEFT / RIGHT selection keys) to the SER parameter.
- Using the UP / DOWN selection keys change the state of the RS232 serial link to one of the following:
  - If the display reads "SERIAL = NO" use the UP / DOWN selection keys to change it and enter the RS232 setup.
  - If the display reads "SERIAL = YES" press the SET key to enter the RS232 setup.

Setting RS232 parameters

To set (change the value of) an RS232 parameter proceed as follows:

- Select the value of the parameter you wish to change using the LEFT / RIGHT selection keys.
- Select the desired new value by using the UP / DOWN selection keys.
- Press the ENTER key for the default value.

The following table gives detailed description of each parameter and its default value:

Parameter	Default	Description
SERIAL	YES	The RS232 activation selection. The RS232 serial link can be disabled here by changing the YES value to NO (This will terminate the RS232 setup mode).
MODE	MON	Operating mode of the RS232 serial link: ◆ MON – remote full screen monitor function (output only). ◆ CNTL – full remote control.
BAUD	9600	RS232 baud rate: 2400, 4800 or 9600.
XON	NO	Select whether to use the XON / XOFF software handshake mechanism.
STOP	-	Number of stop bits: automatically set to 2 when parity is none, otherwise set to 1.
PARITY	NONE	RS232 parity: odd, even or none. Also affects the number of stop bits (see above).
ECHO	NO	Select remote control operating mode: ◆ NO – computer remote control (no echo of input). ◆ YES - terminal (interactive) remote control adds echo of received characters. Can be set to YES only when the operating mode is CNTL.
TERM	100	Select terminal compatibility for the monitor mode: ◆ 52 stands for VT52 (a dumb terminal). ◆ 100 stands for VT100 (an ANSI terminal).

To end the RS232 setup mode, do one of the following:

- Press the SET key.
- Press the SYSTEM key. This will, also, move the cursor to the system symbol.

> Following power-on or a full reset the RS232 serial link activation state is restored from the dip switches located at the back of the unit. If the GPIB link is active as well this might cause a change in the RS232 mode of operation.

Configuring the GPIB link

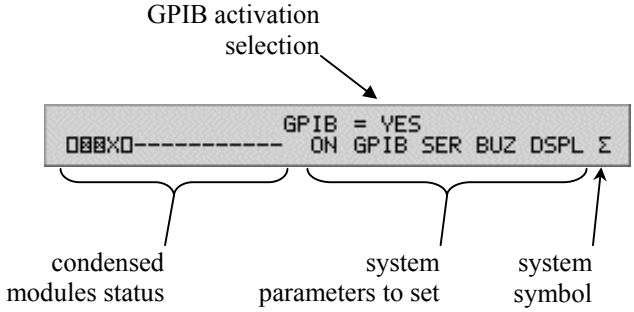
The GPIB communication link is used for remotely controlling the XMP 2600 power supply system.

Activating the GPIB link

Activation of the GPIB communication link is done with the dip switches located at the back of the XMP's master mainframe but it can also be, temporarily, activated using the front panel.

What is displayed

The following illustration shows the way the GPIB communication link is activated (or disabled):



Setup mode display – GPIB link activation

How to, temporarily, activate (or disable) the GPIB

To control the state of the GPIB link proceed as follows:

- Make sure the display is in setup mode.
- Move the cursor (using the LEFT / RIGHT selection keys) to the GPIB parameter.
- Using the UP / DOWN selection keys change the state of the GPIB link to one of the following:
  - "GPIB = NO" to disable the GPIB communication link.
  - "GPIB = YES" to activate the GPIB communication link. Selecting this state, automatically changes the display to the GPIB setup mode.

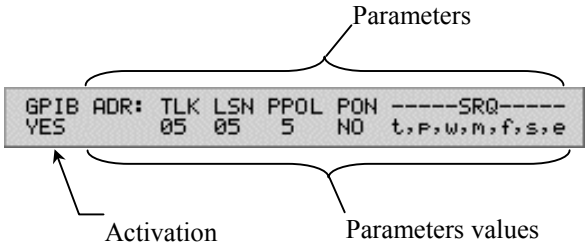
Setting GPIB parameters

The GPIB bus address of the XMP 2600 is set using the dip switches located at the back of the XMP's master mainframe but it can also be, temporarily, set using the front panel.

Other GPIB parameters are set using the front panel.

What is displayed

The following illustration shows the display layout when setting up the GPIB parameters:



Setup mode display – GPIB link setup

In this operating mode, the upper row of the display shows the parameter names while the lower row displays the current values of the parameters.

How to get there

To enter the GPIB communication link setup proceed as follows:

- Make sure the display is in setup mode.
- Move the cursor (using the LEFT / RIGHT selection keys) to the GPIB parameter.
- Using the UP / DOWN selection keys change the state of the GPIB link to one of the following:
  - If the display reads "GPIB = NO" use the UP / DOWN selection keys to change it and enter the GPIB setup.
  - If the display reads "GPIB = YES" press the SET key to enter the GPIB setup.

Setting GPIB parameters

To set (change the value of) a GPIB parameter proceed as follows:

- Select the value of the parameter you wish to change using the LEFT / RIGHT selection keys.
- Select the desired new value by using the UP / DOWN selection keys.
- Press the ENTER key for the default value.

The following table gives detailed description of each parameter and its default value:

Parameter		Default	Description
GPIB		YES	The GPIB activation selection. The GPIB link can be disabled here by changing the YES value to NO (This will terminate the GPIB setup mode).
ADR	TLK	5	The XMP's GPIB link can use different addresses for the talk mode and the listen mode. This is an obscure operating mode that is to be used with great care.
	LSN	Same as TLK	
PPOL		7	The bit number of the parallel poll status line.
PON and SRQ			SRQ mask bits when <u>not</u> working in IEEE 488.2 compatible mode. **Please ignore**.

> Remember to set the LSN address to same value as the TLK address by selecting it and pressing the ENTER key.

To end the GPIB setup mode, do one of the following:

- Press the SET key.
- Press the SYSTEM key. This will, also, move the cursor to the system symbol.

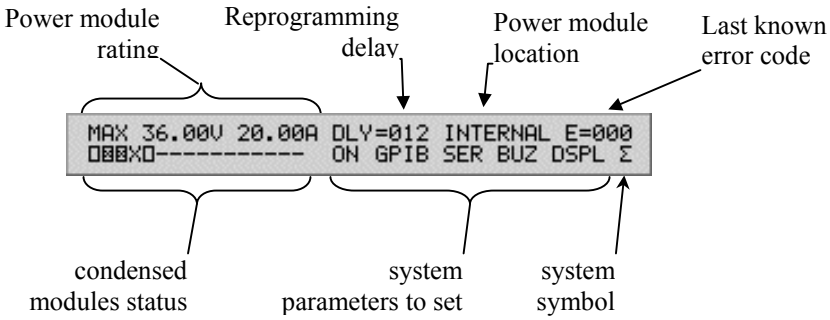
> Following power-on or a full reset the GPIB address and activation state are restored from the dip switches located at the back of the unit. For further details please refer to chapter 2: Installation.

Power module setup

In the setup mode you have access to additional power module parameters and information.

What is displayed

The following illustration shows a typical display of a power module setup.



Setup mode display – power module setup

How to get there

To get to the power module setup proceed as follows:

- Make sure the display is in setup mode.
- Select the power module (move the cursor to the condensed status symbol of the power module) using the LEFT / RIGHT selection keys.

Display details

The information shown on the display during power module setup is summarized in the table bellow:

Parameter	Description
MAX	Power module rating: maximal available output voltage and current.
DLY=	The amount of reprogramming delay (shown in units of 0.1 second). To understand what reprogramming delay is, please refer to the section on setting the reprogramming delay.

Parameter	Description
INTERNAL / EXTERNAL	Power module location: Internal to the master mainframe or external to the master mainframe (residing in an expansion mainframe, connected using a *net* cable).
E=	Last known error code reported by the power module.

Setting the re-programming delay

The reprogramming delay is a feature that eliminates false events due to output transients.

What is reprogramming delay

When a change in the power module's output is commanded (voltage, current, on , off etc.) transients in the output voltage and/or current may occur.

The power module's controller can be programmed to ignore events caused by those transients by defining a reprogramming delay period.

Whenever a change in the power module's output is commanded, the module's controller initiates a reprogramming delay period during which it ignores changes in operating conditions (such as current limit, window warning, OCP etc.).

> The OVP mechanism is a hardware mechanism so it can not be deactivated. During the reprogramming delay period the OVP threshold is set to the maximum value (Vmax + 10%).

How to set the reprogramming delay

Select the power module.

The amount of reprogramming delay to use is set using the numeric entry keys:

- Make sure the display is in setup mode.
- Select the power module (move the cursor to the condensed status symbol of the power module) using the LEFT / RIGHT selection keys.
- Use one of the following methods to set a value for the reprogramming delay:
  - Enter a 3 digits value in units of 100 mS. Alowed range is 0 to 255 (0 to 25.5 seconds).
  - Enter less then 3 digits and press ENTER.
  - To set the value to the factory default, press the DEL key to clear the value and then press the ENTER key.

Power module location and selective shutdown

Power modules can reside in the XMP's master mainframe or in an expansion mainframe. The system controller needs to know the location of the power modules for calculating the mainframe's total output power.

What is selective shutdown

When a power module reports a fault (such as OVP or OCP) it also shuts itself down.

In case several power modules are feeding the same load (or inter-dependant loads), it may be desirable to have other power modules shutdown as well.

To setup this feature, each of the XMP's power modules is defined to be either dependant or independent on other power modules.

There are three shutdown categories available for each power module:

Single shutdown ..... only the power module that detected a fault is shutdown. Other power modules are not affected.

Group shutdown ..... the power module that detected the fault and all other power modules that are defined for a group shutdown, are shutdown.

Global shutdown ..... when the power module is shutdown due to a fault, all the other power modules are shutdown as well.

> ↳ A severe error condition detected by one of the INTERNAL power modules will cause the XMP's main converter to shutdown. If any of the INTERNAL Power Modules is defined as GLOBAL SHUTDOWN then a global shutdown will be performed as well.

How to set the location and selective shutdown

To set the power module's location and selective shutdown behavior proceed as follows:

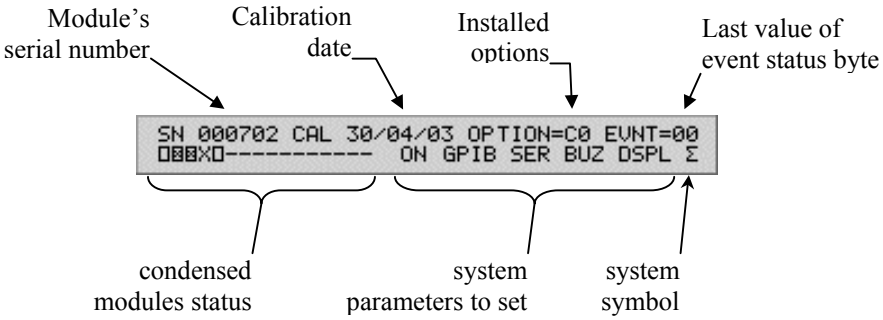
- Make sure the display is in setup mode.
- Select the power module (move the cursor to the condensed status symbol of the power module) using the LEFT / RIGHT selection keys.
- Press either the UP or the DOWN selection key. The upper row of the display will show a confirmation question: "GROUP=NO?".
  - Using the UP / DOWN selection keys change the displayed message to read: "GROUP=YES?".
  - Press the ENTER key to proceed (any other key to abort). The display's upper row will show the current power module location and selective shutdown choice.
    - Using the UP / DOWN selection keys select the desired combination of location (internal / external) and selective shutdown (single / group / global).
    - Press the DEL key for the default of INTERNAL, SINGLE SHUTDOWN.
    - Press the ENTER key to end the selection process.

Viewing module's controller information

Identification and other useful power module information are available when the power module is selected in setup mode.

Serial number and calibration date

Select the power module (move the cursor to the condensed status symbol of the power module) and press the RCL key. The illustration, below, shows a typical display.



Setup mode display – module's controller information

Information shown	Description
Serial number	Power module serial number.
Calibration date	Last power module calibration date: dd/mm/yy.
Installed options	A HEX number representing the power module options byte: ◆ Bit 4.... cleared when the Power Module has output disconnect relay. ◆ Bit 5.... cleared if the Power Module has polarity reversal relays. ◆ Bit 3.... set if this module has power monitoring logic (e.g. $1/8_{wide}$ 36V/40A module)
Event status byte	A HEX number representing the event register of the power module's status structure: ◆ Bit 7: PON : set when a Power On event occurs. ◆ Bit 5: CMD : set when the Power Module detected an error while communicating with the XMP 2600 Main Controller.. ◆ Bit 4: OUT : the Output Register had a bit changed. ◆ Bit 3: ERR : set when an Error event occurred. ◆ Bit 2: FLT : the Faults Register had a bit changed. ◆ Bit 1: WRN : the Warnings Register had a bit changed. ◆ Bit 0: OPC : Operation Complete - the Power Module finished processing the XMP 2600 Main Controller Command. For commands that effect the output of the Power Module, the OPC flag is set when the output settled to within 2% of full scale from the programmed value.

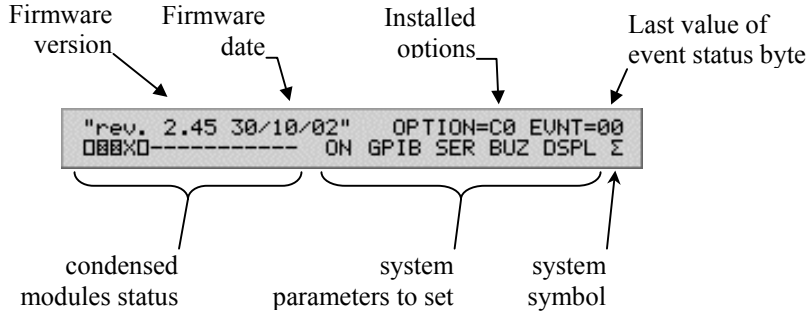
To clear the display, press the SYSTEM key or the LEFT / RIGHT selection keys.

To view more information (shown below) press the RCL key a second time.

Firmware version and date

Select the power module (move the cursor to the condensed status symbol of the power module) and press the RCL key - twice.

The illustration, below, shows a typical display.



Setup mode display – module's controller information

To clear the display, press the SYSTEM key or the LEFT / RIGHT selection keys.

Running a power module test

To conduct a comprehensive power module test, select the power module and press the SET key.

For details see the section on "Power Module Test" in the "Turn-On Checkout" chapter.

CAUTION

During the test operation the Power Module's output might produce up to its rated voltage.

Resetting the power module

To reset the power module to its power on state (full reset, as if power was just turned on), select the power module and press the RESET key.

Calibrating the power module

The XMP 2600 power modules can be calibrated manually using the front panel.

To start the calibration process, press the STO key. The access to the calibration procedure is password protected.

For details on the calibration process please refer to Appendix D.

APPENDIX

A System messages

In the Normal Mode of Operation, the right hand side of the display's lower row may show one of the following System Messages:

← select channel →	in the Status Mode, use the selection (right and left arrow) keys to select a channel.
← Select Item →	in the Channel Programming Mode, use the selection keys to select the item to be programmed.
PRIMARY OVER TEMP.	a primary Over Temperature fault was detected. The outputs where disabled and they will be revived when the temperature drops back to the allowed range.
* MAINS POWER FAIL *	the Mains Power has failed. The outputs are disabled so that they will not decay. As power is restored, the Power Supply undergoes a full reset.
OVER VOLTAGE SHUTDOWN	an Internal Power Module detected a non-controllable OVP fault. The main converter was Shutdown.
OVER CURRENT SHUTDOWN	an Internal Power Module detected a non-controllable OCP fault. The main converter was Shutdown.
CHNL COMM T.O. SHUTDN	an Internal Power Module failed to respond to the Main Controller's queries. The main converter was Shutdown.
* CHANNEL SHUTDOWN *	a Power Module reported a severe error and it is defined as Global, so a Shutdown is initiated due to the Module's condition and definition.
OVP & CHNL SHUTDOWN	a combination of the above.

OCP & CHNL SHUTDOWN	a combination of the above.
T.O. & CHNL SHUTDOWN	a combination of the above.
ARMED: RCL = TRIGGER	the Power Module is armed and the Power Supply is currently in Channel Programming Mode. In that situation, pressing the RCL key sends a trigger to the Power Module.
EXCESS POWER WARNING	the Main Mainframe Power Envelope (for details, see "mainframe power envelope") has been exceeded.
EXCESS POWER SHUTDOWN	the Main Mainframe Power Envelope has been violated. The main converter was Shutdown.
MODULE CAUSED SHUTDOWN	an Internal Power Module caused the main converter to shutdown (by itself).
* EXTERNAL SHUTDOWN *	an external (user supplied) signal caused the main converter to shutdown.
*** PRIMARY FAULT ***	a main converter fault was detected.

APPENDIX

B Error codes

The following is a list of error codes generated by the Power Modules and the main controller of the XMP 2600.

Some of the main controller's error codes pertain only to remote control.

Power Modules

Errors Reported by the Power Module

1 Processor Watchdog was activated.

7 Severe OCP error - output did not shut down.

8 Severe OVP error - output did not shut down.

9 Test error - VOUT zero test failed.

10 Test error - half the full scale VOUT test failed.

11 Test error - OVP circuit did not trip.

12 Test error - OVP circuit did not reset.

13 Output did not shut down.

14 Sense lines voltage drop exceeded 4V.

15 Current Limit was active following a three seconds period of the output being set to zero voltage during a Retry Foldback.

16 Test error - output current was not zero during the output test.

17 Internal Communication Time Out.

18 Internal Communications buffer overflow.

19 output voltage did not drop to zero during the reprogramming period when the relays were operated.

20 Internal Communication Checksum error.

21 Illegal command in the Internal Communications.

22 Internal Communications Command Error.

Errors Detected by the Main Controller

78 Internal Communications Time Out.

251 Internal Communications response by the Power Module was in error.

Errors detected during Channels Scan at Power-On

240 Internal Communications Time Out - Power Module not installed.

241 Power Module has failed its self-test.

242 Internal Communications response by the Power Module was in error.

244 Power Module did not respond with RDY.

247 The Power Module reported spec data did not match the internal table.

Errors detected during Retain or Recall

248 Internal Communications Time Out - Power Module not installed.

Main Controller

Power Modules Communications errors

1 Error during channels scan (power-on).

2 Power Module's response to status query was in error.

3 Communications Interrupt Line is asserted and no Power Module responded to scan.

4 Internal communication receive buffer was full.

16 Internal Communications Time Out for Power Module in channel 1.

17 Internal Communications Time Out for Power Module in channel 2.

18 Internal Communications Time Out for Power Module in channel 3.

19 Internal Communications Time Out for Power Module in channel 4.

20 Internal Communications Time Out for Power Module in channel 5.

21 Internal Communications Time Out for Power Module in channel 6.

22 Internal Communications Time Out for Power Module in channel 7.

23 Internal Communications Time Out for Power Module in channel 8.

24 Internal Communications Time Out for Power Module in channel 9.

25 Internal Communications Time Out for Power Module in channel 10.

26 Internal Communications Time Out for Power Module in channel 11.

27 Internal Communications Time Out for Power Module in channel 12.

28 Internal Communications Time Out for Power Module in channel 13.

29 Internal Communications Time Out for Power Module in channel 14.

30 Internal Communications Time Out for Power Module in channel 15.

31 Internal Communications Time Out for Power Module in channel 16.

RS232 Communications errors

32 Data received while DTR was off (receive buffer is full).

33 Transmit buffer is full.

34 Receive Parity Error.

GPIB Communications errors

48 Bus Error (reported by hardware).

49 Input Queue was full so the Bus Trigger command cannot be executed.

50 Input Queue was full so the EOI message (set on last character which is not a LF) cannot be processed.

Parser and Execution errors

37 Communications Driver error (false End Of Command).

39 The Parser lost synchronization with the Input Stream (processing a non-existing command).

64 a miss-placed CR in the Input Stream.

65 Command or Query Mnemonics are too long (more than 6 characters).

66 Illegal Command or Query (first character).

67 Illegal Command or Query.

68 Missing parameter (value).

69 Non-digit character in Numeric Parameter.

70 Parameter value overflow.

71 Parameter value is less than zero (negative).

72 Not a valid Channel Number (should be in the range 1 to 16).

73 Parameter value is out of its allowed range.

74 Can not display the string.

75 The referenced Channel has no operative Power Module installed.

76 The referenced Storage Area is empty - no data to recall.

77 Protection settings cannot be programmed (Auto Protection Mode is on).

79 Can not turn Global On while a Channel Shut is in effect.

80 No Polarity Relays installed for the referenced Power Module.

81 No Disconnect Relay installed for the referenced Power Module.

82 The XMP 2600 is not in 488.2 Mode.

83 The XMP 2600 is in 488.2 Mode.

84 Can not clear the Sequence Program while it is running.

APPENDIX

C Test results

The Power Module Test or Confidence Test result is made out of two bytes. The first byte is the result of the latest performed test, and the second byte is the result of an on-going confidence test of the analog section of the controlling circuits.

A set bit (value of 1) indicates a fault.

BYTE 1

ANLG MUX	DAC	ANLG REF	PWR SUPPL	NOVR AM_B	NOVR AM_A	PROG MEM	INT RAM

INT_RAM *Processor Memory.*
PROG_MEM *Program Memory.*
NOVRAM_A *Non-Volatile Memory A.*
NOVRAM_B *Non-Volatile Memory B.*
PWR_SUPPL *Control circuits power supplies*
ANLG_REF *Analog section reference voltage.*
DAC *Digital to Analog Converter.*
ANLG_MUX *Analog signal paths.*

- Light shaded bits are of tests performed during Power-On only.
- Dark shaded bits are of tests performed during both Power-On and Power Module Test.

BYTE 2

				VSET	IOUT	VLOAD	VOUT

VOUT *VOUT measurement confidence test.*
VLOAD *VLOAD measurement confidence test.*
IOUT *IOUT measurement confidence test.*
VSET *VSET controlling signal confidence test.*

APPENDIX

D Calibration

It is possible to calibrate the XMP 2600 power modules from the front panel but it is not recommended. Better results will be obtained when using the appropriate calibration kit that includes:

- Test and calibration software.
- Test and calibration harness.
- Test and calibration manual.

The calibration process requires good quality instruments and is best performed by a qualified laboratory.

If you do want to calibrate the XMP power modules by yourself please contact the manufacturer or your local distributor.

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