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# SPELLMAN

Valhalla, NY, USA

**CONFIGURATION SWITCH IS SET FOR MODEL 205B-05R. PLEASE REFER TO PAGES 5 TO SET SWITCH FOR YOUR UNIT.**

# INSTALLATION

# AND

# OPERATING

# INSTRUCTION MANUAL

# MODEL

# 200-C488

## WARNING

THIS UNIT CONTROLS HAZARDOUS VOLTAGES. DO NOT APPLY INPUT POWER UNLESS ADEQUATE GROUNDING IS PROVIDED TO THE POWER SUPPLY AND THE HIGH VOLTAGE OUTPUT HAS BEEN PROPERLY CONNECTED.

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## SECTION I INTRODUCTION/SPECIFICATIONS

### 1.0 SCOPE OF MANUAL

This manual is provided to assist the user in the installation and operation of the Spellman Model 200-C488 IEEE-488 interface for the Spellman Series 205A/210 high voltage power supplies. For the protection of personnel and equipment, it is essential that this manual be thoroughly read prior to the installation and application of power.

### 1.1 PURPOSE OF EQUIPMENT

The model 200-C488 greatly enhances the versatility of the Series205A/210 high voltage power supplies. IEEE-488 controllable devices are now found in many different fields, such as engineering and science, information processing, medicine, industrial process control as well as research and development.

### 1.2 DESCRIPTION

The 200-C488 is an interface that allows a GPIB controller to program and monitor a Series 205A/210 high voltage power supply. In addition to duplicating the front panel operation, the 200-C488 provides the user with a number of additional functions such as programmable overload detection and response. The GPIB controller may send commands to the interface that programs the output and set other user programmable parameters, and read back output meter readings and status information.

The 200-C488 is a single 19inch rack mountable unit that is 3-1/2 inches high. It is AC powered (115/230 Vac switch selectable) and connects to the high voltage power supply via a single seven-conductor cable.

### 1.3 ELECTRICAL SPECIFICATIONS

Input Power: 115/230Vac $\pm$10%, 50 – 60 Hz

Interface: A seven conductor cable is used to connect the 200-C488 and the 205A/210 Series power supply. The user is supplied with the mating connectors and must solder the conductors in the length that is required. The pin A's of the two mating connector are connected, the pin B's are connected, and likewise for each of the seven pins A through H.

| PIN: | FUNCTION: |
|---|---|
| A | -5Vdc reference from 250A/210 |
| B | 0 to –5Vdc programming signal to 205A/210 |
| C | Ground |
| D | Current monitor signal from 205A/210 |
| E | Voltage monitor signal from 205A/210 |
| F | Reserved |
| H | Reserved |

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The user must provide the IEEE-488 cable, which is required to interface the Model 200-C488 to the users GPIB network.

| | | |
|---|---|---|
| GIPB Functions: | SH1 | Source Handshake |
| | AH1 | Acceptor Handshake |
| | T1 | Talker |
| | L1 | Listener |
| | SR1 | Service Request |
| | DT1 | Device Trigger |

Using these GPIB functions the GPIB controller may send ASCII command strings to control and monitor the high voltage power supply.

Size: 19.0”W X 3.5”H X 9.5”D (483 X 83 X 242mm)

Weight: 10lbs (4.6kg)

## SECTION II GENERAL DESCRIPTION

**CAUTION- THE UNIT BEING CONTROLLED BY THE 200-C488 CAN STORE HAZARDOUS VOLTAGE. COMPLETELY DISCHARGE HIGH VOLTAGE AT REAR PANEL GROUND TERMINAL BEFORE ATTEMPTING REMOVAL OF THE HIGH VOLTAGE CABLE.**

### 2.1 INSTALLATION

The Model 200-C488 IEEE 488 interface can amount in a standard 19” rack.

### 2.2 INPUT POWER

Input AC line voltage required is 115/230 Vac $\pm$ 10%, 50 – 60 Hz, single phase. The LINE VOLTAGE selector switch on the rear panel selects either 115Vac operation.

### 2.3 PROGRAM CONTROL SWITCH

Before the Series 205A/210 may be used in a GPIB system, the power supply must be configured by setting the power supply’s rear panel REMOTE/LOCAL control switch in the remote position.

### 2.4 GPIB ADRESS SWITCH

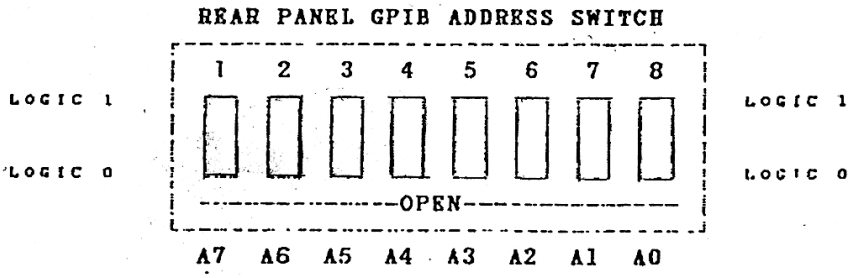
Located on the rear panel of the 200-C488 is an eight-position DIP switch. Every instrument on a GPIB must have am unique bus address in the range 0 to 30, inclusive. The address is set with five switches A4 through A0, A4 the most significant bit and A0 the least significant bit. Bits A5 and A7 of the address switch must remain at the logic zero state. Bit A6 control whether the 200-C488 will terminate character strings with or without a carriage return and a linefeed. Figure 2.1 shows the switch orientation and bit designations.

The GPIB address switch is only read on power- on. Therefore, when the address is to be changed, the unit must be turned off and then back on.



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FIGURE 2.1



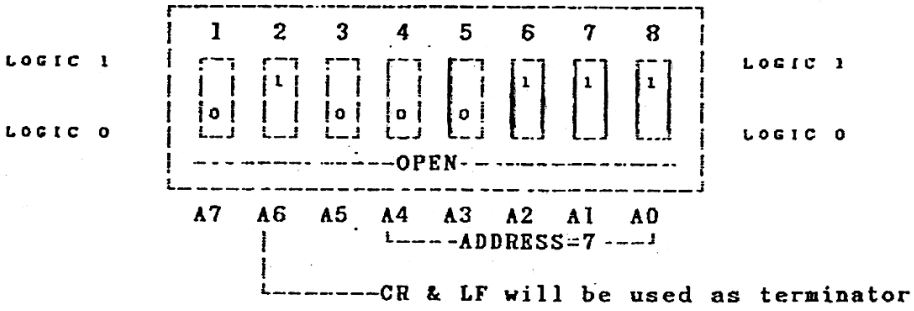

A7 Set to 0

A6 Line Terminator: 1 Carriage Return & Linefeed
0 No Character Terminator

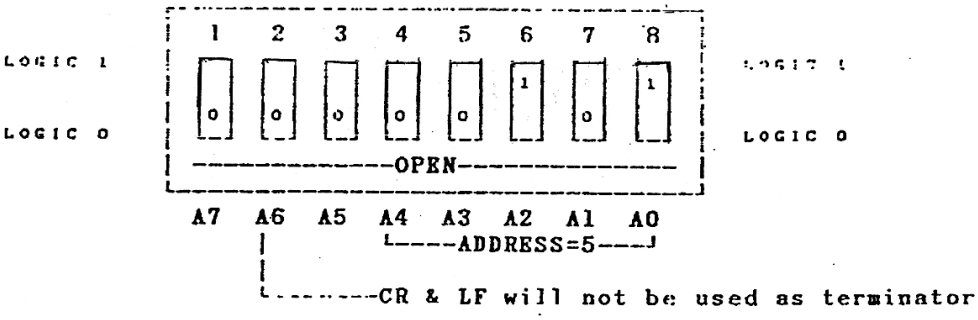
A5 Set to 0

A4 GPIB Address MSB
A3 GPIB Address Bit
A2 GPIB Address Bit
A1 GPIB Address Bit
A0 GPIB Address LSB

FACTORY SETTING:




ALTERNATIVE EXAMPLE:




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## 2.5 CONFIGURATION SWITCH

Since a 200-C488 interface may be used with any Spellman Series 205A/210 high voltage power supply, the 200-c488 must be configured to implement the correct data formats for each supply. After removing the top cover of the 200-C488, a six position DIP switch may be seen on the large printed circuit board. Table 2.1 shows the correct setting for each power supply.

As with the GIPB switch the configuration switch is only at power-on and if it is to be changed, the unit must be turned off and then back on, or reset. Figure 2.2 is a representation of the switch, as it would be seen on the PCB.

**FIGURE 2.2**

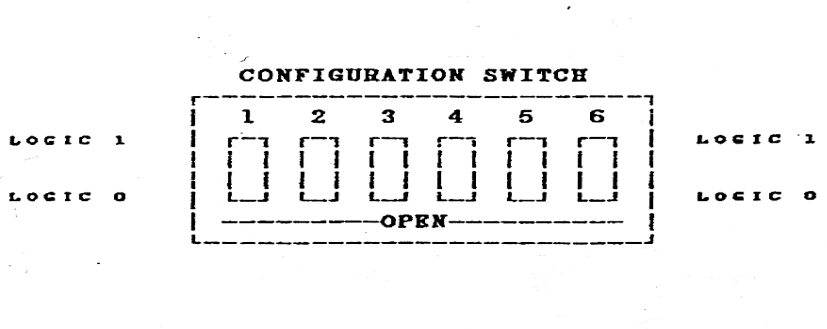



**Table 2.1**

**CONFIGURATION SWITCH SETTINGS BY MODEL**

| | SWITCH POSITION | | | | | |
|---|---|---|---|---|---|---|
| MODEL: | 1 | 2 | 3 | 4 | 5 | 6 |
| 205A/B-01R | 0 | 0 | 0 | 0 | 0 | 0 |
| 205A/B-03R | 0 | 0 | 0 | 0 | 0 | 1 |
| 205A/B-05R | 0 | 0 | 0 | 0 | 1 | 0 |
| 205A/B-10R | 0 | 0 | 0 | 0 | 1 | 1 |
| 205A/B-20R | 0 | 0 | 0 | 1 | 0 | 0 |
| 205A/B-30R | 0 | 0 | 0 | 1 | 0 | 1 |
| 205A/B-50R | 0 | 0 | 0 | 1 | 1 | 0 |
| 210-01R | 0 | 0 | 0 | 1 | 1 | 1 |
| 210-01.5R | 0 | 1 | 1 | 1 | 1 | 0 |
| 210-02R | 0 | 1 | 0 | 0 | 0 | 0 |
| 210-03R | 0 | 0 | 1 | 0 | 0 | 0 |
| 210-05R | 0 | 0 | 1 | 0 | 0 | 1 |
| 210-10R | 0 | 0 | 1 | 0 | 1 | 0 |
| 210-20R | 0 | 0 | 1 | 0 | 1 | 1 |
| 210-30R | 0 | 0 | 1 | 1 | 0 | 0 |
| 210-50R | 0 | 0 | 1 | 1 | 0 | 1 |
| 210-75N/P | 0 | 0 | 1 | 1 | 1 | 0 |
| 210-100N/P | 0 | 0 | 1 | 1 | 1 | 1 |



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## SECTION III GPIB OPERATION

**CAUTION – THE UNIT BEING CONTROLLED BT THE 200-C488 CAN STORE HAZARDOUS VOLTAGE. COMPLETELY DISCHARGE HIGH VOLTAGE AT REAR PANEL GROUND TERMINAL BEFORE ATTEMPTING REMOVAL OF THE HIGH VOLTAGE CABLE.**

### 3.1 GPIB PROTOCOL

The 200-C488 implements the following GPIB Functions:

| | |
|---|---|
| SH1 | Source Handshake |
| AH1 | Acceptor Handshake |
| T1 | Basic Talker & Serial Poll |
| L1 | Basic Listener |
| SR1 | Service Request |
| DC1 | Device Clear |
| DT1 | Device Trigger |

Using these GPIB functions, the GPIB controller may send ASCII command strings to control and monitor the high voltage power supply.

#### 3.1.1 DATA TRANSFER FUNCTIONS – SH1, AH1, T1, L1

SH1, AH1, T1, and L are data transfer functions, and normally transparent to the User. These functions permit the communication between the GPIB controller and the Model 200-c488 interface.

#### 3.1.2 SERVICE REQUEST FUNCTIONS – SR1

SR1 contains two sub-functions; Service Request and Serial Poll. The service request is the mechanism by which the 200-C488 may interrupt the GPIB controller and the serial poll is how the GPIB controller may read the status of the 200-C488.

##### 3.1.2.1 SERVICE REQUEST

There are two conditions that will cause the 200-C488 to generate a service request; at power-on and during user programmed overload detection. The meaning of the serial poll status byte that is read depends on the condition that caused the service request. The power –on mode is true when the 200-C488 is first turned on and before the GPIB controller sends a command to the interface. The overload detect mode is after the GPIB control has sent its first command to the interface. Any service request may be ignored without affecting operation of the interface or power supply.

##### 3.1.2.2 SERIAL POLL

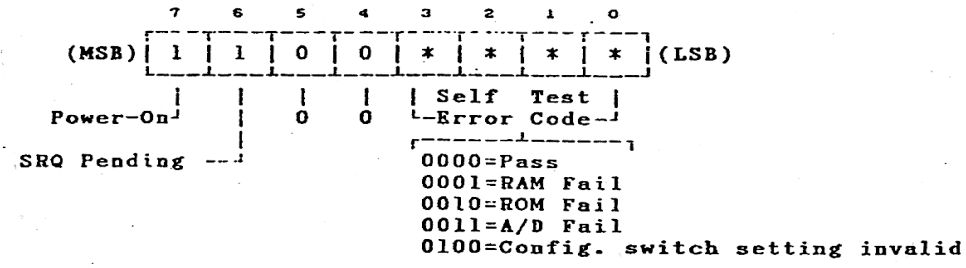
When the GPIOB controller executes a serial poll, the 200-C488 sends it one byte of status. As mentioned above, the decoding of the status byte is dependent on when it is read. The FIGURE 3.1 below shows the decoding of the power-on status byte, and FIGURE 3.2 shows the decoding of the ‘normal operation” (not the power-on) status byte.



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**FIGURE 3.1**

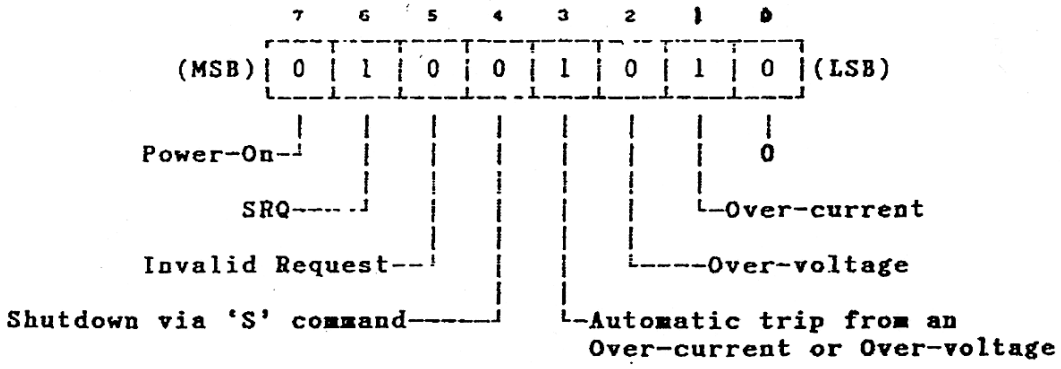
At power –on before any command is sent, the status byte is:




Note that the MSB is logic 1 which identifies this byte as the status register contents at power on, prior to the issuance of any command. IF the user does not do a serial poll at power on and sends any command, the status byte obtained in response to a subsequent serial poll will appear as seen in FIGURE 3.2 below.

FIGURE 3.2

After first command the register looks like this:




Note that the MSB of this byte is logic 0 which identifies this byte as the status register contents following the issuance of at least one command since power on.

When the SQR bit is logic 1, it means this status byte is in response to the first serial poll following the issuance of an SRQ. If the SQR bit is logic 0, it means that the status byte obtained is one you have previously examined and/or is not in response to a service request.

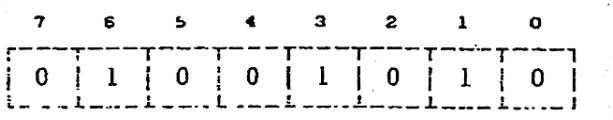
When the invalid request bit is logic 1, it means that you have issued a command the unit cannot recognize. Normally this bit stays at logic 0.

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A logic 1 in any of the five remaining bits indicates a “true” state of that parameter. A logic 0 indicates a “false”.

**EXAMPLE BIT PATTERN**




| BIT | MEANING: | |
|---|---|---|
| 7 | 0: | You are looking at the status byte after at least one command |
| 6 | 1: | You are making your first examination of this byte after the unit’s issuance of an SQR. |
| 5 | 0: | The previous command was valid. |
| 4 | 0: | You have not shut down the unit with a “S” command. |
| 3 | 1: | You did get a trip (a turning off) of high voltage in response to either a voltage or current overload |
| 2 | 0: | The supply is not in voltage overload. |
| 1 | 1: | The supply is in current overload. |
| 0 | 0: | This bit of this status byte is always logic 0. |

### 3.1.3 DEVIC CLEAR FUNCTION – DCI

The device clear and selective device clear GPIB functions set the high voltage output to 0 volts regardless of the current voltage program. They perform to 0 volts regardless of the current voltage program. They perform identically to the user command ‘S’ explained in section 3.2.4.

### 3.1.4 DEVICE TRIGGER FUNCTION – DTI

The device trigger function is used to update the previously programmed parameters. It performs the same as the user command ‘G’, explained in section 3.2.3, and has the additional capability of triggering numerous bus instruments simultaneously.

## 3.2 USER COMMANDS

The 200-C-488 recognizes a number off commands, in the form of ASCII strings. These commands execute the various programming and monitoring functions enabling the user to control a Spellman Series 20A/210 high voltage power supply. These commands are:

- Programming the Output Voltage (‘P’)
- Setting Output Voltage and Current Limits (‘L’)
- Shutting off the High Voltage Output (‘S’)
- Restoring the High Voltage Output (‘R’)
- Selecting the Overload Shutdown Response (‘C’)
- Selecting the Overload Service Request Response (‘N’)
- Triggering Meter Readings of the Output (‘T’)



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**NOTE: All characters in the ASCII command string must be in <u>UPPER CASE ONLY</u>. The interface will not recognize lower case characters.**

The syntax of the commands is fairly rigid, especially the format of the numeric voltage and current strings. Table 3.0 shows the numeric formats for programming the Model 200-C488 high voltage power supply.

**TABLE 3. 0**

**NUMERIC FORMATS FOR PROGRAM, LIMIT & METER COMMANDS:**

| | FORMAT | | CURENTS |
|---|---|---|---|
| **MODEL** | **VOLTAGE** | **CURRENT** | **UNITS** |
| 205A/B-01R | x.xxxx | xx.xxx | M |
| 205A/B-03R | x.xxxx | xx.xxx | M |
| 205A/B-05R | x.xxxx | x.xxxx | M |
| 205A/B-10R | xx.xxx | x.xxxx | M |
| 205A/B-20R | xx.xxx | x.xxxx | M |
| 205A/B-30R | xx.xxx | xxx.xx | U |
| 205A/B-50R | xx.xxx | xxx.xx | U |
| | | | |
| 210-01R | x.xxxx | xxx.xx | M |
| 210-01.5R | x.xxxx | xxx.xx | M |
| 210-02R | x.xxxx | xxx.xx | M |
| 210-03R | x.xxxx | xx.xxx | M |
| 210-05R | x.xxxx | xx.xxx | M |
| 210-10R | xx.xxx | xx.xxx | M |
| 210-20R | xx.xxx | x.xxxx | M |
| 210-30R | xx.xxx | x.xxxx | M |
| 210-50R | xx.xxx | x.xxxx | M |
| 210-75N/P | xx.xxx | x.xxxx | M |
| 210-100N/P | xxx.xx | x.xxxx | M |

### 3.2.1 PROGRAMMING THE HIGH VOLTAGE OUTPUT ('P')

This command allows the user to set the output voltage of the power supply. The syntax is:

'P {numeric string} K'

Where {numeric string} is an ASCII string of five digits with a decimal point. The resolution of the programming value (and monitors) is five digits. Since a Series 205A/210 power supply may each have a different output rating, the programming command will have different formats. In general, the program command will be one of those shown below:

Px.xxxxK
Pxx.xxxK

The numeric format (x.xxxx or xx.xxx) will depend on the unit being controlled. This numeric format must be packed with zeros to fully fill five digits and decimal point. Therefore, if a 1kV power supply, with format x.xxxx is to be programmed to 230 volts, the command will be P0.2300K. If a 20kV supply is to be programmed to 11,500 volts, the command will be P11.500K.

The actual high voltage output will not change after the program command until the 200-C488 receives a device trigger bus command or the 'G' command string (see sections 3.1.4 and 3.2.3).

### 3.2.2 SETTING THE OUTPUT LIMITS ('L')

The 200-C488 monitors the power supply output voltage and current to detect if the parameters exceed the user thresholds. Each parameter (voltage and current) is monitored at the rate of once per second. The user may set threshold limits that when exceeded will invoke the user programmed shutdown and service



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request responses (see section 3.2.6 and 3.2.7). The limit commands start with an 'L' followed by a numeric string that represents the threshold value, then followed by a character that distinguishes between the voltage and current limits. A'K' indicates a kilovolt limit and an 'M' or 'U' indicates a milliamp or microamp limit respectively. The syntax is:

'L {numeric string} K' Kilovolt Limit
'L {numeric string} M' Milliamp Limit, or
'L {numeric string} U' Microamp Limit

where {numeric string} is as described Table 3.0. It is very likely that the numeric formats for the voltage and current will be different.

The voltage limit command uses the same numerical format as the programming command, but starts will an 'L'. Below are some examples:

| | |
|---|---|
| Lx.xxxxK | L0.6523K limits to 652.3V |
| Lxx.xxxK | L29.400K limits to 29.4kV |

The output current limit threshold may also be set. When this value is exceeded the 200-C488 will respond as programmed by the user. This command also requires a strict numerical format. Since it represents output current, the decimal point, may be in a different position than the voltage format. Below are some examples of the current limit command.

| | |
|---|---|
| Lxx.xxxM | L12.000M limits to 12mA |
| Lx.xxxxM | L1.0500M limits to 1.05mA |
| Lxxx.xxU | L473.50U limits to 473.5uA |

The actual limit values will not change after the limit command until the 200-C488 receives a device trigger bus command or the 'G' command string (see sections 3.1.4 and 3.2.3).

### 3.2.3 ENTERING THE CURRENT PROGRAMMING & LIMIT VALUES ('G')

After executing a programming or limit command, these new values will not be used immediately. The user must execute the 'G' command that will update the current values with the new ones. Therefore, if the output is currently programmed to 1kV and the user executes a program command such as 'P1.5000K, the output will not change until the 'G' command is executed. The syntax is:

'G' the single ASCII character

When timing is not important, the 'G' may be appended to the programming or limiting command as shown below.

Pxx.xxxKG
lx.xxxxMG

### 3.2.4 SHUTTING THE HIGH VOLTAGE OUTPUT ('R')

The high voltage output may be turned back on to the currently active programming level after it was shut off by a user command 'S' or a trip due to overload. The syntax. The syntax is:

'S' the single ASCII character

This is the same effect as executing the device clear bus command.

### 3.2.5 RESTORING THE HIGH VOLTAGE OUTPUT ('R')

The high voltage output will return to the value that was programmed before the shutdown. If the output is off because of an overload trip, the cause of the overload should be corrected before restoring the output voltage or the trip will occur again.



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### 3.2.6 SELECTING THE OVERLOAD TRIP RESPONSE ('C')

When the 200-C488 detects that the power supply has exceeded one of the user-programmed limits, it may respond by shutting off the high voltage output, also known as tripping. The user may select that the power supply be tripped for a voltage overload, a current overload, either a voltage or current overload, or neither. The syntax is:

'C {numeric}'

where {numeric} is the ASCII byte for 0, 1, 2, or 3 and:

C0 Enable the overvoltage and overcurrent control to shut down the power supply upon detection of an output voltage or current above their respective limit setting(s).

C1 Enable the overvoltage control to shut down the power supply upon detection of an output voltage above the voltage limit setting only.

C2 Enable the overcurrent control to shut down the power supply upon detection of an output current above the current limit setting only.

C3 Disable the overvoltage control and overcurrent control.

### 3.2.7 SELECTING THE OVERLOAD SERVICE REQUEST RESPONSE ('N')

Just as the 200-C488 may be made to shut off the output during an overload, it may be may to generate a service request to the GPIB controller. The syntax is:

"N {numeric}'

where {numeric} is the ASCII byte for 0, 1, 2, or 3 and:

N0 Enable SQR in response to an overvoltage or overcurrent detection.

N1 Enable SQR in response to an overvoltage detection only.

N2 Enable SQR in response to an overcurrent detection only.

N3 Disable SQR in response to an overvoltage or overcurrent detection.

When an SRQ is received, the user should execute a serial poll of the unit, the status byte will be the result of the serial poll. Please note that overload enabling/disabling and service request choices operate independently of each other.

### 3.2.8 TRIGGERING METER READINGS OF THE OUTOPUT ('T')

The 200-C-488 has the capability to perform meter readings of the power supply output voltage and current. The user may trigger a reading of the output voltage, current or both. The syntax is:

'T {numeric}'

where {numeric} is the ASCII byte for 0,1 or 2 and:

T0 Triggers a measurement of the output voltage and current.

T1 Triggers a measurement of the output voltage only.

T2 Triggers a measurement of the output current only.



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Since this is an ASCII string it may be printed directly to the CRT or printer. After receiving the 'T' command the 200-C488 will return a character string containing the output status (Normal, Tripped or Shutdown) and the voltage and/or current readings in the same numerical format as is used to enter voltage and current values. Below are the 'T' commands with representative measurement strings that would be returned from the 200-C488.

| | | |
|---|---|---|
| T0 | 'N Vxx.xxxK | Ix.xxxxM' |
| T1 | 'N Vx.xxxxK' | |
| T2 | 'N Ixxx.xxU' | |

Where the 'N' in the string means the output is on. It may be replaced with an 'S' that means the output was shutdown by user with an 'Z' command or device clear bus command, or a 'T' in that means the output was tripped due to an overload detection where:

'V' in the string means voltage
'I' in the string means current
'K' in the string means kilovolts
'M' in the string means milliamps
'U' in the string means microamps

## SECTION IV MAINTANENANCE

### 4.1 GENERAL

The 200-C488 interface should not require any maintenance or calibration. It is designed for reliable, trouble free operation. If any question should arise, contact the Spellman Customer Service Department for assistance or return authorization. Although adequate information is provided in this manual, it is suggested that the unit be returned to the factory if service should become necessary.



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