

OPERATION & MAINTENANCE MANUAL

PULSE RECTIFIERS

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Quick Start Instructions

Insure that your PULSE rectifier is properly installed according to all electrical codes. See installation instructions.

Note: Never set the PULSE rectifier at the maximum pulse frequency and pulse width initially. When starting the unit for the first time, insure that the frequency is set to minimum 1000 Hz and the pulse width to minimum 10.0 microseconds.

Your PULSE rectifier uses push buttons to set the operation of the rectifier, follow the instructions to set up your PULSE rectifier for operation.

The following four buttons control the setting of the PULSE rectifier.

SET



↑



↓



RUN



To start rectifier, make sure that the pipeline or structure to be protected is connected to the negative terminal on the front panel of the PULSE Rectifier, and the anode system is connected to the anode terminal. Turn on the power at the main breaker, then turn the switch on the front panel of the PULSE rectifier to ON. The LED lights and the display should light up for a few seconds while the unit does a self-test. When the LED extinguish with the exception of one green LED and the display.

PRESS THE SET BUTTON the green LED will extinguish and one of the red LED will light.

TO SET THE PULSE FREQUENCY:

PRESS THE SET BUTTON until the red led opposite **FREQ** is illuminated. then press and hold the ↑ button until the desired frequency is shown on the display.

TO SET PULSE WIDTH:

PRESS THE SET BUTTON until the red led opposite **WIDTH** is illuminated. then press and hold the ↑ button until the desired pulse width is shown in microseconds on the display.

TO OPERATE THE PULSE RECTIFIER:

PRESS THE RUN BUTTON, The PULSE rectifier will now operate at the frequency and pulse width programmed.

Introduction:

Your new PULSE rectifier utilises the latest state of the art technology to control the flow of DC current. By utilising pulse mode technology for the control of the DC output very high conversion efficiencies can be achieved. Pulse mode technology, is a process whereby direct current DC is chopped into square wave pulses many thousands of times per second. By varying the number of pulses per second and the duration or width of the pulse, complete control of the output can be achieved.

Alternating current enters the PULSE rectifier from the mains supply, this alternating current power may be delivered at 50 hertz or 60 hertz depending on the local AC frequency.

This alternating current passes through a magnetic hydraulic breaker, which opens the circuit in the event of overload. The magnetic hydraulic breaker has a trip curve such that the higher the overload the quicker the breaker will open protecting the rectifier from damage in the event of a surge or damage to internal components.

The mains power then energises the primary of the isolation transformer, the isolation transformer can step-up or step-down the mains voltage. The isolation transformer has a built in electrostatic shield to minimise the transfer of voltage surges that may occur on the primary side to the secondary side.

A bridge rectifier converts the alternating current on the secondary side of the transformer, to direct current. A filter circuit consisting of a choke and capacitor's smoothes the DC output. This results in a 300 to 350 volt DC supply with less than 5% ripple feeding the pulse circuit.

The DC power is chopped into square wave pulses with the DC output determined by the frequency of the pulses and the width of the pulses. The pulse frequency and pulse width are under software control. The pulse modules are controlled by a microprocessor on the master board, which contains the display and push buttons.

The output of the PULSE rectifier is adjusted by the push buttons on the front panel. The output range is fully adjustable between the programmed limits. The pulse frequency is adjustable in 1 Hz steps from 1000 to 5000 Hz, the pulse width is adjustable in 0.1 microsecond steps from 10 to 99 microseconds.

The output of the pulse rectifier is indicated by the analog meters on the control panel.

Fusing as well as surge protection is provided in the DC output circuit to prevent damage from surges and short circuits.

Installation Instructions:

Install the PULSE rectifier in an area where it will be protected from traffic, animals and personnel. If located in an area subject to pedestrian traffic install the PULSE rectifier at a sufficient height above grade to protect pedestrian traffic from bumping into the rectifier. The PULSE rectifier should be installed according to the electrical code in effect in the jurisdiction.

The PULSE should be installed in a location where they will not be subject to vandalism, floods, fire or other conditions which could lead to failure of the rectifier or its components.

A fused disconnect switch should be provided within 5 feet (1.5 M) of the PULSE rectifier. An electrical ground consisting of a minimum of two 10 foot (3 M) ground rods should be installed as close as possible to the PULSE rectifier. A bare copper ground cable should be connected between ground rods and the fused disconnect and the PULSE Rectifier. For lightning protection it is important that the PULSE rectifier case be connected by a bare copper cable of as short as possible length to the two driven ground rods.

If the primary supply to the PULSE rectifier is 240 volts AC the line, and ground must be connected between the fused disconnect and the PULSE rectifier. The supply wires should be coiled to introduce some inductance in the wiring to attenuate surges before the wiring enters the rectifier. An open coil of 10 to 15 turns with a diameter of approximately 10mm will usually introduce sufficient inductance to minimise surges.

The supply should be brought into the cabinet at the back or through the bottom and connected to the terminal block on the side of the PULSE rectifier internal rack.

The output wiring to the structure and anode system should be brought into the PULSE rectifier cabinet through the hole in the bottom and run to the front panel. The DC wiring should be coiled to introduce some inductance in the circuit. An open coil consisting of 10 to 15 turns with a diameter of 25 to 50 mm and placed underground before entry of the wiring to the PULSE rectifier usually suffices to reduce surges. The rectifier case should be grounded to make it intrinsically safe and to provide a path for fault or surge currents. We recommend that at a minimum two ground rods 3 meters long spaced 6 meters apart and connected together and to the rectifier by as a minimum # 4 bare copper cable.

To minimize electrical noise from the Pulse Rectifier, install the DC wiring in Rigid steel conduit grounded to the rectifier cabinet.

Operation PULSE Rectifiers:

OPERATING INSTRUCTIONS

PULSE RECTIFIERS

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Note: Never set the PULSE rectifier at the maximum pulse frequency and pulse width initially. When starting the unit for the first time, insure that the frequency is set to minimum 1000 Hz and the pulse width to minimum 10 microseconds.

Your PULSE rectifier uses push buttons to set the operation of the rectifier, follow the instructions to set up your PULSE rectifier for operation.

The following four buttons control the setting of the PULSE rectifier.

SET

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**RUN**

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PRESS THE SET BUTTON the green LED will extinguish and one of the red LED will light.

TO SET THE PULSE FREQUENCY:

PRESS THE SET BUTTON until the red led opposite WIDTH is illuminated. then press and hold the ↑ button until the desired pulse width is shown on the display.

TO SET PULSE WIDTH:

PRESS THE SET BUTTON until the red led opposite FREQ is illuminated. then press and hold the ↑ button until the desired frequency is shown in microseconds on the display.

TO OPERATE THE PULSE RECTIFIER:

PRESS THE RUN BUTTON, The PULSE rectifier will now operate at the frequency and pulse width programmed.

Maintenance:

Your PULSE rectifiers need minimal maintenance, keep the case clean by wiping with a wet cloth to remove dirt and debris. Check the operation of the rectifier on a weekly basis and record the output voltage and current, make adjustments to the output as is necessary due to changes in the ground bed resistance.

The electronic components and interior of the PULSE rectifier should be kept clean and dust free. Turn OFF the rectifier and lock out the electrical service before cleaning the interior surfaces of the PULSE rectifier to prevent a shock hazard.

Regularly inspect the surge and lightning protection devices and if there is any evidence of damage they should be replaced immediately.

Insure that the electrical ground conductor and ground rods are in good condition to safely drain faults from the rectifier to ground.

If the PULSE rectifiers are kept clean they should give many years of trouble free operation.

A parts list is shown in Appendix B.

Appendix A Block Diagram

APPENDIX A
Block Diagram

Appendix B Parts List

Parts List

| PULSE RECTIFIER PN | PAB1SX2500L MANU | DESCRIP | QTY |
|-----------------------|---------------------|----------------------------|-----|
| 1471C24 | HAMMOND | RECTIFIER ENCLOSURE | 1 |
| CS3371CX/50/S1/X | REX | TRANSFORMER 240V PRI | 1 |
| SKM400GAR062D | CATH-TECH | IGBT | 1 |
| SKHI10 | CATH-TECH | DRIVER PCB | 1 |
| JA2S-K3EB01DAW | HEINEIMAN | CIRCUIT BREAKER 15A | 1 |
| LCP11765-1 | LPC | TRANSIENT SURGE SUPPRESSOR | 1 |
| CGS242T450X5L | MALLORY | CAPACITOR 2400UF 450VDC | 3 |
| 30080E6/L | REX | REACTOR 80UH 30A 60HZ | 1 |
| 35MB40A | I/R | RECTIFIER BRIDGE | 2 |
| TTC | VICOR | HEATSINK | 1 |
| PMR-PR | CATH-TECH | PMR CCA (INC FR PANEL) | 1 |
| OTP-116 | CATH-TECH | FIRMWARE FOR PM | 1 |
| OTP-117 | CATH-TECH | FIRMWARE FOR PM | 1 |
| SW 50A/50MV | HOLLOWAY | SHUNT 50A/50MV | 1 |
| 3-151 | CINCH JONES | TERMINAL BLOCK 3 WAY | 1 |
| MS3-151 | CINCH JONES | MARKER STRIP | 2 |
| HKP | BUSSMANN | FUSE HOLDER | 1 |
| AGC2 | BUSSMANN | FUSE 2 AMP | 1 |
| Z480EH6 | CKE SURGE | ARRESTOR | 1 |
| ANL-35 | BUSSMANN | FUSE 35 AMP | 1 |
| 15A 125V | EAGLE | RECEPTACLE 125V 15A | 1 |
| 001-85003 | LEVITON | COVER PLATE | 1 |
| 250-320 SFSF | YOKOGAWA | METER 0-500VDC | 1 |
| 250-324 ECNT | YOKOGAWA | METER 0-500VDC | 1 |
| HPF | BUSSMANN | FUSE HOLDER | 1 |
| FNQ-15 | TRON | FUSE 15 AMP | 1 |