

# ISOLATING AMPLIFIERS



## 3.1 INTRODUCTION

This section describes the Telcon range of Isolating DC Amplifiers which has found a wide variety of applications for the control and instrumentation of electrical power systems. This has included the original application of isolating and amplifying the output from an ammeter shunt, expanding to the provision of signals proportional to system voltages and currents in closed loop control systems, and extending to the monitoring of electrical parameters for energy management systems.

### 3.1.1 Operating Principle

The block diagram in figure 5 is for the MDTZ unit but the basic principle is the same for all of the units.

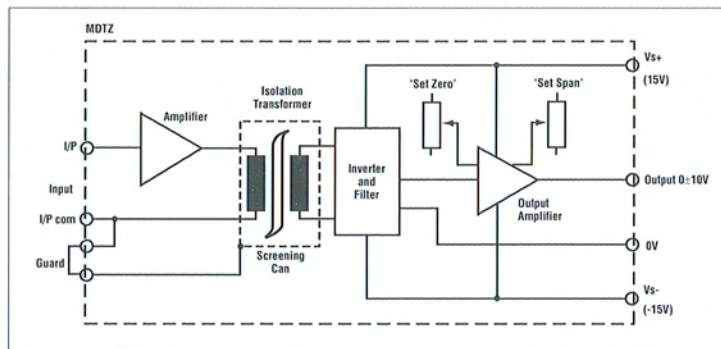


Figure 5

### 3.1.2 Application Notes

#### Isolating Current Transducer

(Current Shunt Amplifier)

The input sensitivity of the Isolating Amplifier should be matched to the signal available from the current shunt to give the best working range. See figure 6.

'Twisted pair' input leads help to reduce interference.

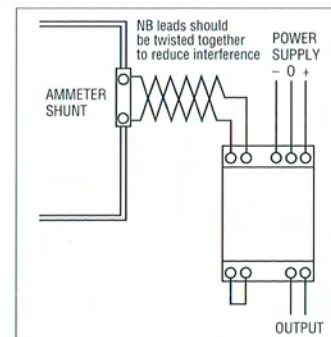


Figure 6

#### Isolating Impedance Changers

The high input impedance of the Isolating Amplifier makes it possible to interface with very low current circuits in such devices as data loggers, chart recorders etc. R1 is chosen to suit. See figure 7.

The attenuator may be required to match the input requirements of the chart recorder/data logger etc. to the output from the isolating amplifier.

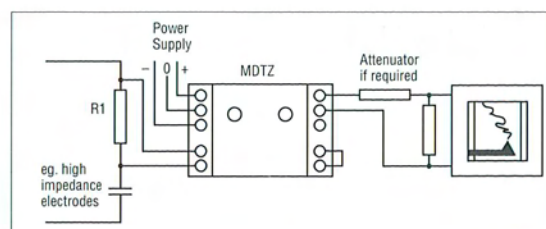


Figure 7

# ISOLATING AMPLIFIERS

## 3.1.2 Application Notes

### DC Voltage Transformer

The high input impedance of the Isolating Amplifier simplifies the fitting of a resistive potential divider to the input to enable their use in providing the function of a d.c. voltage transformer.

In order to preserve linearity over the required measurement range, the values should be chosen to provide nominal output at peak input voltage. Any input sensitivity can be used, but the 500mV input is recommended as this

is the highest input sensitivity for which an internal potential divider is not fitted. It will also give the lowest ratio of  $R1:R2$ , where  $R2$  is the resistor fitted across the input terminals.

$R2$  should be kept high enough to keep dissipation low in the divider, but low enough to maintain  $R1$  as a practical value.

### Power Supply Considerations

It is recommended that all Isolating Amplifiers are used with regulated d.c. supplies, preferably tracking to reduce zero offset errors.

All MDT types have internal decoupling capacitors and high speed Transzorb suppression diodes across the supply lines to protect against spikes and interference.

Where the Isolating Amplifier is not fitted close to the power supply, additional protection may be added as shown in figure 8. The zener or Transzorb will only be needed for use with the RHTZ.

MDTC units should not be powered with the output circuit disconnected.

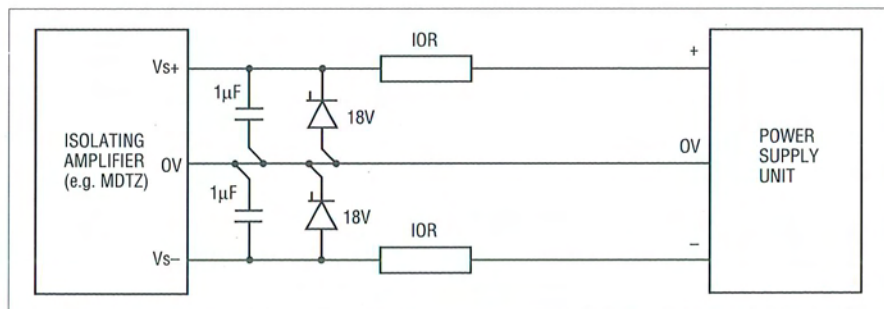


Figure 8

## 3.2 PRODUCT RANGE

### 3.2.1 Features

- Wide range in inputs (50mV to 1200V)
- 6kV proof stress test input to output
- High input impedance
- High input overload protection
- DIN rail mounting
- No 'front end' power supply requirement
- Wide range of standard outputs

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## 3.2.2 Range Summary

### MDTC

Unit available with unidirectional or reversing inputs with unidirectional current output either 'live zero' 4-20mA or standard 0-20mA. Available with inputs from 50mV to 1200V. 'Set Zero' and 'Set Span' controls settable by user.

Power supply +28V to +40V. See figure 9.

(N.B. The MDTC is not suitable for loop-powered, two wire operation.)

## Transfer Characteristics

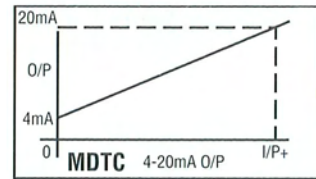


Figure 9

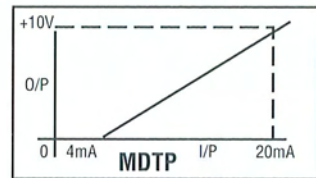
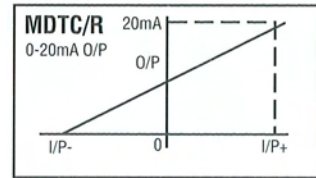


Figure 10

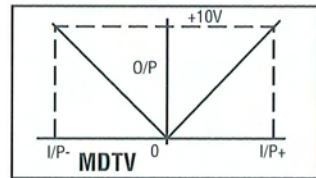


Figure 11

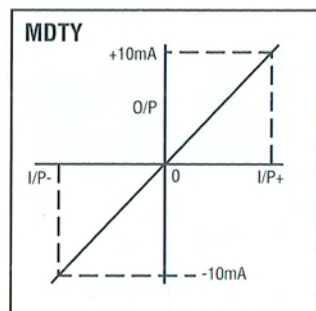


Figure 12

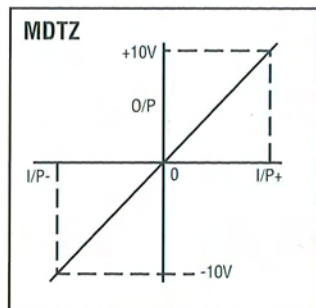


Figure 13

### MDTP

Unit to convert 'live zero' 4-20mA input signal to 0 to 10V output. 'Set Zero' and 'Set Span' controls settable by user.  $\pm 15V$  power supplies. See figure 10.

### MDTV

Unit giving unidirectional 0 to 10V output for reversing inputs. Available with inputs from 50mV to 1200V. 'Set Zero' and 'Set Span' controls adjustable by user.  $\pm 15V$  power supplies. See figure 11.

### MDTY

Reversing unit with  $\pm 10mA$  current output. Available with inputs from 50mV to 1200V. 'Set Zero' and 'Set Span' controls adjustable by user.  $\pm 15V$  power supplies. See figure 12.

### MDTZ and RHTZ

Reversing unit with output  $\pm 10V$  at up to 20mA. Available with inputs from 50mV to 1200V. 'Set Span' and 'Set Zero' controls adjustable by user.  $\pm 15V$  power supplies. RHTZ has 'set zero' control only. See figure 13.

### MDTZ-HV

Generally as MDTZ, but offering four alternative inputs of 600V, 800V, 1kV and 1.2kV in one unit. An optional high impedance output with 40dB attenuation at 300Hz is available in addition to the standard output.



# ISOLATING AMPLIFIERS

## 3.3 TECHNICAL DATA

### Electrical

	MDTC	MDTP & MDTV	MDTY
Nominal Power Supply, Vs	32V		±15V
Power Supply Limits	28 to 40V		±14V to ±16V
Absolute Maximum Ratings	44V		±18V
Nominal Output Range	4 to 20mA 0 to 20mA	0 - 10V	±10mA
Maximum Output Voltage <sup>1</sup>	Vs - 7V	0 - 13V	±12V
Supply Current	24mA + output		±28mA + output current
Operating Temperature Range		0 to 50°C	
Storage Temperature Range		-25°C to 85°C	

### Accuracy-Dynamic Performance

	MDTC	MDTP & MDTV	MDTY
Frequency Response	n/a	dc-800Hz	dc-800Hz
Rise/Fall Time (typ)	0.6mS	n/a	n/a
Input Impedance (min) <sup>2,4</sup>		5MΩ except MDTP <sup>3</sup>	
Accuracy		Depending upon span adjustment	
Linearity		±0.5%	
Span Adjustment (typ)	±2.5%	±15%	±15%
Set Zero Adjustment (typ)	±0.25mA	0 - 0.5V	±1mA
Output Impedance		2Ω	
Output Ripple (typ)	70μA rms	30mV rms	10μA rms
Output Ripple Frequency	6kHz		7kHz
Output Variation			
i. with Temperature	<2μA/°C	±3mV/°C	±3μA/°C
ii. with Supply	<1μA/V	-30mV/V	30μA/V
iii. with Magnetic Field	<100μA/mT	50mV/mT	50μA/mT

### General

	MDTC	MDTP & MDTV	MDTY
Weight	250g	250g	250g
Housing	DIN box	DIN box	DIN box
Mounting	DIN rail 46277	DIN rail 46277	DIN rail 46277

### Proof Stress

All units 6kV, ac, rms, for 1 minute, input to output and fixings. RHTZ additionally 500V, ac, rms for 1 minute output to case.

#### Notes

1. Output of the MDTY will be current limited at ±14mA for load resistance below 800Ω and voltage limited for higher values.

2. Value applies for input sensitivities from 50mV to 500mV. For higher input sensitivities, the following approximate values apply:

10V input - 86kΩ  
600V input - 360kΩ  
800V input - 480kΩ

1kV input - 780kΩ  
1.2kV input - 1.1MΩ

3. Input impedance of the MDTP is 10Ω

4. Input impedance of MDTZ-HV

600V input - 810kΩ  
800V input - 1.1MΩ  
1kV input - 1.3MΩ  
1.2kV input - 1.6MΩ



# ISOLATING AMPLIFIERS



## 3.3 TECHNICAL DATA

### Electrical

	MDTZ	RHTZ
Nominal Power Supply, Vs	±15V	
Power Supply Limits	±14V to ±16V	
Absolute Maximum Ratings	±18V	
Nominal Output Range	±10V	
Maximum Output Voltage	±13V	±11V
Supply Current	±28mA + output current	±12mA + output current
Operating Temperature Range	0 to 50°C	
Storage Temperature Range	-25°C to 85°C	

### Accuracy-Dynamic Performance

	MDTZ	RHTZ
Frequency Response	dc - 800Hz	dc - 1kHz
Input Impedance (min) <sup>2,4</sup>	5MΩ	300kΩ
Accuracy	Depending on span adjustment	2%
Linearity	±0.5%	±1%
Span Adjustment (typ)	±15%	n/a
Set Zero Adjustment (typ)	±0.5V	±0.2V
Output Impedance	2Ω	2Ω
Output Ripple (typ)	30mV rms	100mV rms
Output Ripple Frequency	7kHz	7kHz
Output Variation		
i. with Temperature	±3mV/°C	±5mV/°C
ii. with Supply	-30mV/V	-30mV/V
iii. with Magnetic Field	50mV/mT	0.5V/mT

### General

	MDTZ	RHTZ
Weight	250g <sup>5</sup>	800g
Housing	DIN box	steel cased semi rigid polyurethane filled
Mounting	DIN rail 46277	M5 clearance holes

**Note:** 5. Weight of MDTZ-HV is 310g.

# ISOLATING AMPLIFIERS

## 3.3 TECHNICAL DATA

### Dimensions (mm)

Dimensional data for the range of Isolating Amplifiers and power supplies is given in figure 14.

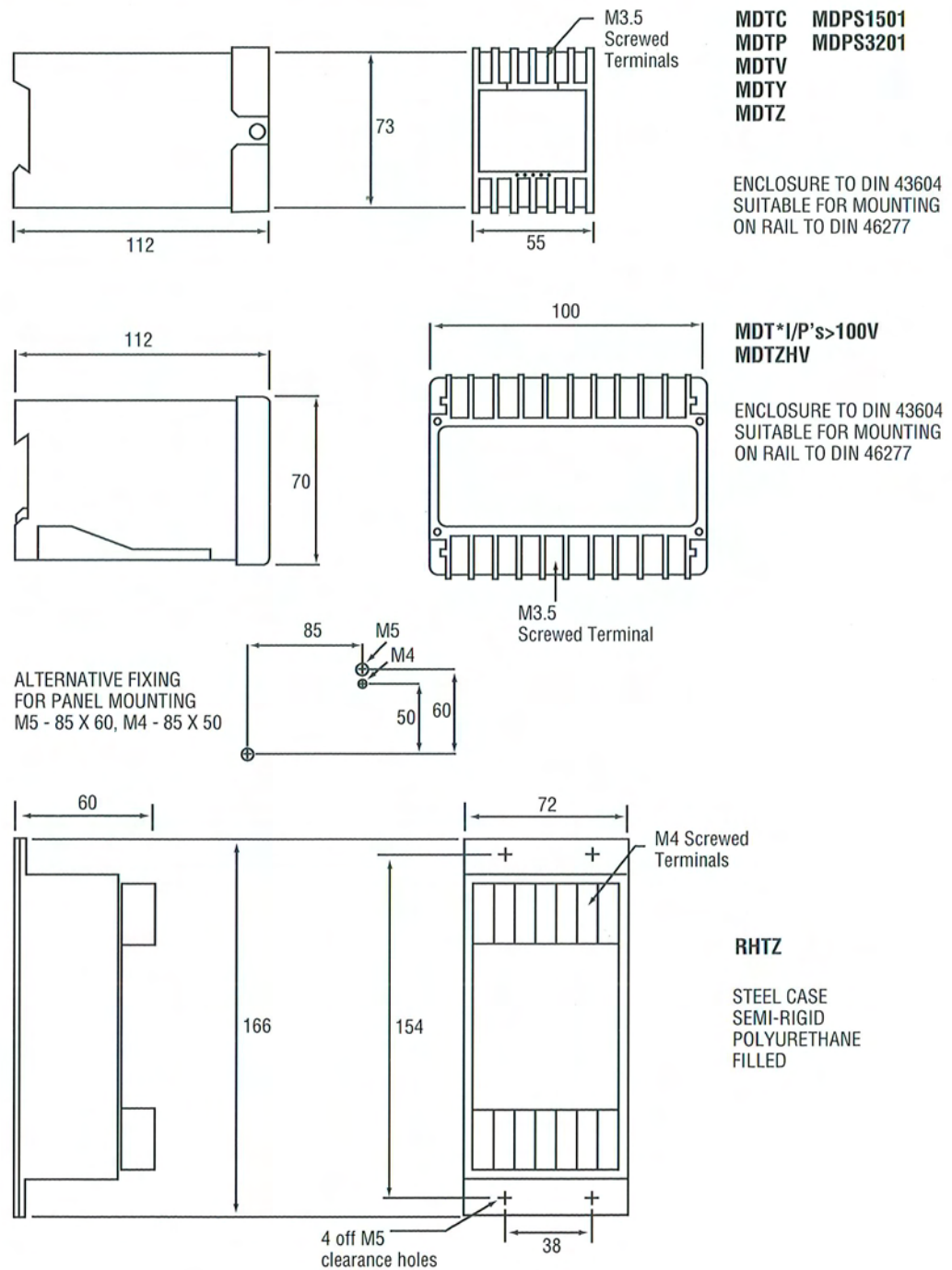
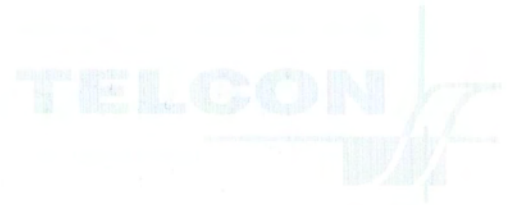


Figure 14

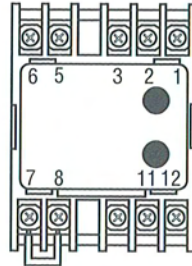
# ISOLATING AMPLIFIERS



## 3.3 TECHNICAL DATA

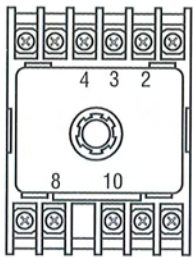
### Terminal Assignments

Connection information for the range of Isolating Amplifiers and power supplies is given by the terminal assignment detail in figure 15.



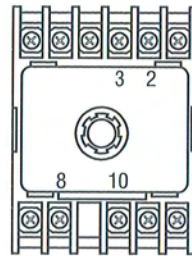
#### MDTC, P, V, Y, Z

- Tmnl 1 Vs+
- 2 0V
- 3 Vs- (Not MDTC)
- 5 Input Common
- 6 Input
- 7 Input Guard
- 8 Input Common
- 11 0V
- 12 Output
- 2/11 Connected internally
- 5/8 Connected internally
- 7/8 External link



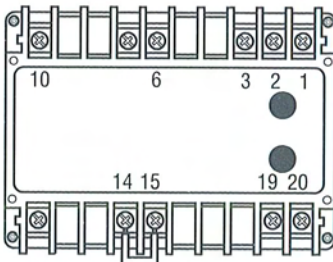
#### MDPS1501

- Tmnl 2 Vs+ (+15V)
- 3 0V
- 4 Vs- (-15V)
- 8 a.c. Line
- 10 a.c. Neutral



#### MDPS3201

- Tmnl 2 Vs+ (+32V)
- 3 0V
- 8 a.c. Line
- 10 a.c. Neutral

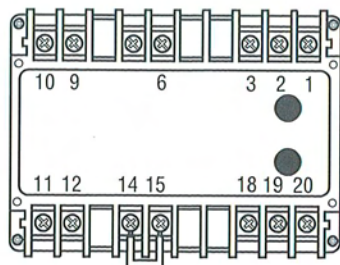


#### MDTC, V, Y, Z with internal potential divider

- Tmnl 1 Vs+
- 2 0V
- 3 Vs- (Not MDTC)
- 6 Input Common
- 10 Input
- 14 Input Guard
- 15 Input Common
- 19 0V
- 20 Output
- 2/19 Connected internally
- 6/15 Connected internally
- 14/15 External link

#### MDTZHV

- Tmnl 1 Vs+
- 2 0V
- 3 Vs-
- 6 Input Common
- 9 1kV Input
- 10 1.2kV Input
- 11 800V Input
- 12 600V Input
- 14 Input Guard
- 15 Input Common
- 18 Filtered Output
- 19 0V
- 20 Standard Output
- 2/19 Connected internally
- 6/15 Connected internally
- 14/15 External link



#### RHTZ

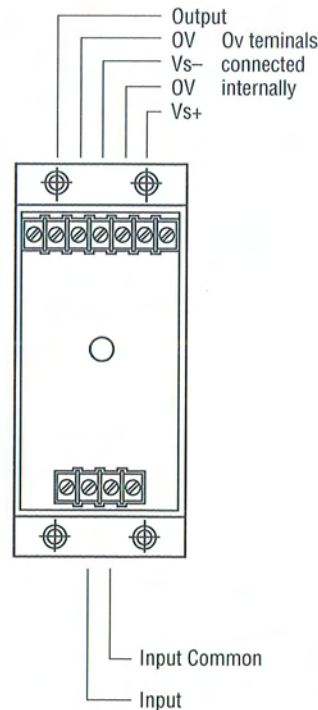


Figure 15



# ISOLATING AMPLIFIERS

## 3.4 POWER SUPPLIES

The MDPS1501 and MDPS3201 are simple regulated power supplies introduced primarily as power sources for the Telcon range of Isolating Amplifiers, enabling the end-user to obtain a power supply mechanically compatible with the various DIN rail mounted units.

The MDPS1501 provides positive and negative 15V rails rated up to 100mA output current, and the MDPS3201 a single +32V rail, rated at 100mA.

### Applications

The MDPS1501 is designed to run continuously at 100mA per rail at the maximum supply voltages. Working at currents higher than this may result in internal power dissipation too high for the heat-sinking provided and the output may shut down due to the inherent action of the regulators. However if one rail is being run at 20mA or less, the other rail may be run at currents up to 125mA.

The MDPS3201 is not short circuit proof. Although

Both units are based on industry standard linear series regulators giving good supply tolerance and regulation, and low output ripple at full output current.

Both units are available in two versions, for nominal 110V and 240V supply voltages, and are housed in a moulded case to DIN43604 suitable for 35mm fixing rails to DIN46277.

acceptable for the regulator used, internal power dissipation will be too high for the enclosure used. A line fuse is therefore fitted to prevent overheating under conditions of excess output current.

For both units, the operating temperature range is that to allow maximum output current at maximum input voltage. For operation at 50°C ambient, the units may be derated to 80mA or the input voltage limited to the nominal value.

### Specification

Input Voltage Range - 110V units	110V, -12%, +20%, 50/60Hz
- 240V units	240V, -15%, +10%, 50/60Hz

	MDPS1501	MDPS3201
Output Voltage	±15V, ±5%	32V, ±1%
Output Current Range	0-100mA dc	0-100mA dc
Regulation	0.1%(typ)	0.2% (typ)
Output Ripple	<5mV rms	<3mV rms
Proof Stress Test Voltage	2.5 kV ac rms 50Hz for 1 minute	
Operating Temperature Range	0 - 40°C	
Storage Temperature Range	-25 to + 85°C	



# ISOLATING AMPLIFIERS



## 3.5 ORDERING CODES FOR ISOLATING AMPLIFIERS

Standard input sensitivity for MDTP is 4:20mA. All other units are available with standard inputs of 50, 75, 100, 150, 250 and 500mV, 10, 600, 800, 1000 and 1200V. The RHTZ is available with the same standard inputs, but limited to 10V maximum.

Units in the MDT range with inputs up to 100V will be supplied in the 55mm wide enclosure and above 100V in the 100mm wide enclosure.

All units with input sensitivities above 500mV will be fitted with an internal potential divider, resulting in a lower input impedance than the 5M $\Omega$  quoted in the specification for the MDT range and the 300k $\Omega$  quoted for the RHTZ.

Typical ordering codes will be e.g.

MDTZ75mV	$\pm 75\text{mV I/P, } \pm 10\text{V O/P}$
MDTZ 10V	$\pm 10\text{V I/P, } \pm 10\text{V O/P}$
MDTY 500mV	$\pm 500\text{mV I/P, } \pm 10\text{mA O/P}$
MDTY 800V	$\pm 800\text{V I/P, } \pm 10\text{mA O/P}$
MDTV 100mV	$\pm 100\text{mV I/P, } 0\text{-}10\text{V O/P}$
MDTC 75mV/0-20mA	$0\text{-}75\text{mV I/P, } 0\text{-}20\text{mA O/P}$
MDTC/R/150mV/4-20mA	$\pm 150\text{mV I/P, } 4\text{-}20\text{mA O/P}$
MDTP	$4\text{-}20\text{mA I/P, } 0\text{-}10\text{V O/P}$
MDTZHV	$\pm 600\text{V}/800\text{V}/1\text{kV}/1.2\text{kV I/P, } \pm 10\text{V O/P}$

## ORDERING CODES FOR POWER SUPPLIES

For 110V a.c. systems	MDPS1501/110V
	MDPS3201/110V
For 240V a.c. systems	MDPS1501/240V
	MDPS3201/240V