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MR-NVD Technical Manual

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1. P&B MR-NVD

P&B Protection Relay's MR-NVD is a highly sophisticated microprocessor based feeder protection relay, specifically designed to be used on low or medium voltage feeders as an integral part of any type or manufacture of distribution equipment.

MR-NVD monitors the voltage typically by means of conventional voltage transformers of the neutral point of the incoming supply (the star point of either the generator or transformer). The zero sequence current that flows for an earth fault on an unearthed network is determined by the capacitance of the cable/ busbars to earth. This flow of current leads to a rise in the neutral point voltage, it is this rise, which is detected by the MR-NVD.

The MR-NVD is a withdrawable, easily installed package. The MR-NVD can be used as a replacement for older MR-NVD relays by removing the relay module from the switchgear mounted casing and fitting the new MR-NVD in its place, some wiring changes are required to ensure compatibility.

All setting parameters are programmed independently for each unit via the integral keypad and liquid crystal display on the front plate or via any of the communication ports and PC based software package available for the Vision series of products.

During operational conditions the LCD also gives access to accurate load, statistical and fault data such as; Neutral Voltage, Time to Trip, In Service Hours, Number of operations.

Tri-Colour Light Emitting Diodes mounted on the front plate give immediate visual indication of the breaker status i.e. HEALTHY / IRF / INHIBIT and ALARM / FAULTY / HEALTHY conditions.

The MR-NVD can also be integrated onto an RS485 based network. This allows measured, statistical and status information from the relay to be reported to a remote central communicating system.

Pages 23 and 24 can be used as a template for your relay settings schedule.

1.1 Protective Functions.

Neutral Voltage Displacement (overvoltage)

1.2 Displayed Feeder Data.

Neutral Voltage (Vd)
No of Operations
Digital Input 1 Status
Digital Input 2 Status
Time to Trip
Healthy / Fault.
Alarm - Description - Pre-Alarm Values
Trip Description - Pre- Trip Values

1.3. Control Functions.

Via Hardwired inputs:	*Via Keypad*	*Via Comms input:*
Block, Reset	Reset	Reset

2. Technical Specification.

Power Supply.

AUXILIARY POWER SUPPLY & LOW VOLTAGE POWER SUPPLY	
AC Nominal	Range 80 – 265V AC / DC Range 24V AC / 24-48V DC (Low Voltage Power Supply Optional Extra)
Frequency	45 - 65 Hz
Maximum Power Consumption	10VA, 15VA Nominal

Measurement.

PHASE VOLTAGE MEASUREMENT	
Method	True RMS, Sample time <1ms
Range	0.1 to 2x Phase VT Primary Volts
Accuracy	± 3% at Phase VT Primary Volts

Protection Functions.

OVERLOAD ALARM AND TRIP THRESHOLD	
Fault Time Accuracy	± 20mS up to 10 seconds ± 2% of trip time over 10 seconds
Threshold Voltage Level	Overload Setting ± 2%

Relay Contacts Ratings.

OUTPUT RELAYS	
Rated Load	10A @ 250 AC 10A @ 30V DC
Maximum Breaking Voltage	250V AC
Max Making Current (max. 4s at duty cycle 10%)	35A
Max Breaking Capacity AC	2500VA
Max Breaking Capacity DC	600mA @ 110V DC 100mA @ 220V DC

3. Environmental Tests.

CLIMATIC	TEST STANDARD	SEVERITY LEVEL
Temperature Dry Cold Operational	IEC 60068-2-1	-20 deg C ,96 hrs
Temperature Dry Cold Transportation & Storage	IEC 60068-2-1	-40 deg C , 96hrs
Temperature Dry Heat Operational	IEC 60068-2-2	+60 deg C , 96 hrs
Temperature Dry Heat Transportation & Storage	IEC 60068-2-2	+85 deg C , 96 hrs
Damp Heat Steady State	IEC 60068-2-30	95% Non-condensing, Cyclic Test Db
Enclosure	IEC 60529	front IP52 , rear IP00
MECHANICAL		
Vibration	IEC 60255-21-1	Class I
Shock & Bump	IEC 60255-21-2	Class I
Seismic	IEC 60255-21-3	Class I
ELECTRICAL		
Insulation resistance	IEC 60255-5	500 Vdc , 5 secs
Dielectric Test	IEC 60255-5	Series C of table 1 2.5 kV 50Hz , 1 min 1.0 kV open contacts , 1 min
High Voltage Impulse	IEC 60255-5	5 kV peak 1.2/50uS,0.5J 3 pos , 3 neg
Voltage Dips , Short Interruptions & Voltage variations immunity	IEC 60255-11 IEC 61000-4-11	3 dips & 3 interruptions at 10 sec intervals of duration between 10mS and 500mS at zero crossings. Variations 40% &70%
Ripple in dc supply	IEC 60255-11	12% ac ripple
VT input Thermal Withstand		120% Vn , continuous
CT input Thermal Withstand		250xIn half wave,100xIn for 1 second 30 xIn for 10 second , 4 xIn cont.
ELECTROMAGNETIC COMPATIBILITY		
Electrical fast Transient/Burst	IEC 60255-22-4 IEC 61000-4-4	Class IV-4.0kv Power supply Class III -2.0 kV Other inputs 1 min each polarity
Oscillatory Waves 1 Mhz Burst	IEC 60255-22-1	Class III Longitudinal 2.5 kV , 2sec Transverse 1.0 kV , 2 sec
Electrostatic Discharge	IEC 60255-22-2	Class II 6 kV contact 8kV air discharge , 10 discharges at 1 sec intervals
Conducted Disturbance RF fields	IEC 61000-4-6	0.15 to 80 Mhz Severity Level 10Vrms +sweeps 0.05-0.15MHz & 80-100MHz
Radiated e-m field from digital portable telephones	ENV 50204	900 & 1890mhz at 10V/m
Radiated RF e-m field immunity test	IEC 60255-22-3	Class III test method A +sweep 500-1000mhz or IEC 1000-4-3 80-1000mhz severity 10V/m 80% modulated 1 kHz
Surge Immunity	IEC 61000-4-5	4kV common mode 2kV differential mode , 1.2/50uS
Power Frequency Magnetic Field	IEC 61000-4-8	1000A/m for 1 sec 100A/m for 1 minute
Pulse Magnetic Field	IEC 61000-4-9	6.4/16uS , 1000A/m
Damped Oscillatory Magnetic Field Immunity	IEC 61000-4-10	0.1 & 1.0 Mhz , 100A/m
Conducted & Radiated RF Interference Emission	EN55022 or EN55011or EN50081-2	Class A interference limits
Power frequency conducted immunity, common mode	IEC 61000-4-16 IEC 60255-22-7	DC to 150kHz sweep test level 4 300V at 16 2/3 & 50/60Hz

4. Inputs and Outputs.

4.1. Power Supply Live.

The MR-NVD requires a permanent AC or DC Voltage to supply the unit as specified by the relay rating label. This auxiliary live is also used as the source voltage to power the digital inputs.

4.2. Voltage Transformer Inputs.

The MR-NVD has provision to allow connection of standard single phase voltage transformers with typical secondary voltages of 110V or 240V ac. It is also possible, under special circumstances, to allow the MR-NVD to accept capacitor-divider derived secondary voltages.

4.3. Output Relays.

The MR-NVD has 4 output relays which can be assigned depending upon the required function.
Each output relay is a changeover contact with Common (C) and Normally Open (NO) and Normally Closed (NC) contacts.

4.4. Digital Inputs.

The MR-NVD has 2 digital inputs which provide an indication of statuses to the relay of the breaker condition.

The condition of all these inputs can be viewed at any time via the Display Scroll page of the relay, this enables complete wire checking without the need to disconnect or even gain access to the rear panel wiring. The source voltage for the digital inputs is derived from the auxiliary power supply, when power is connected, these terminals may be live.

4.5. RS485 Rear Port.

The RS485 port utilises a half duplex RS485 protocol allowing up to 32 units to be daisy-chained together with a single shielded twisted pair cable.

The host system can interrogate the unit to monitor status, running loads, historical data and fault data as well as control functions such as reset of fault / alarm conditions. Setting parameters may also be changed or read.

The MR-NVD is available with P&B network gold (P&B protocol) installed for use with the Xcell Data Concentrator for fully Integrated Protection, Control & Monitoring Systems with full dual redundancy or with a Slave implementation of Modbus RTU protocol for small systems and direct Modbus access to devices where data concentration is not required.

4.6. RS232 Front Port.

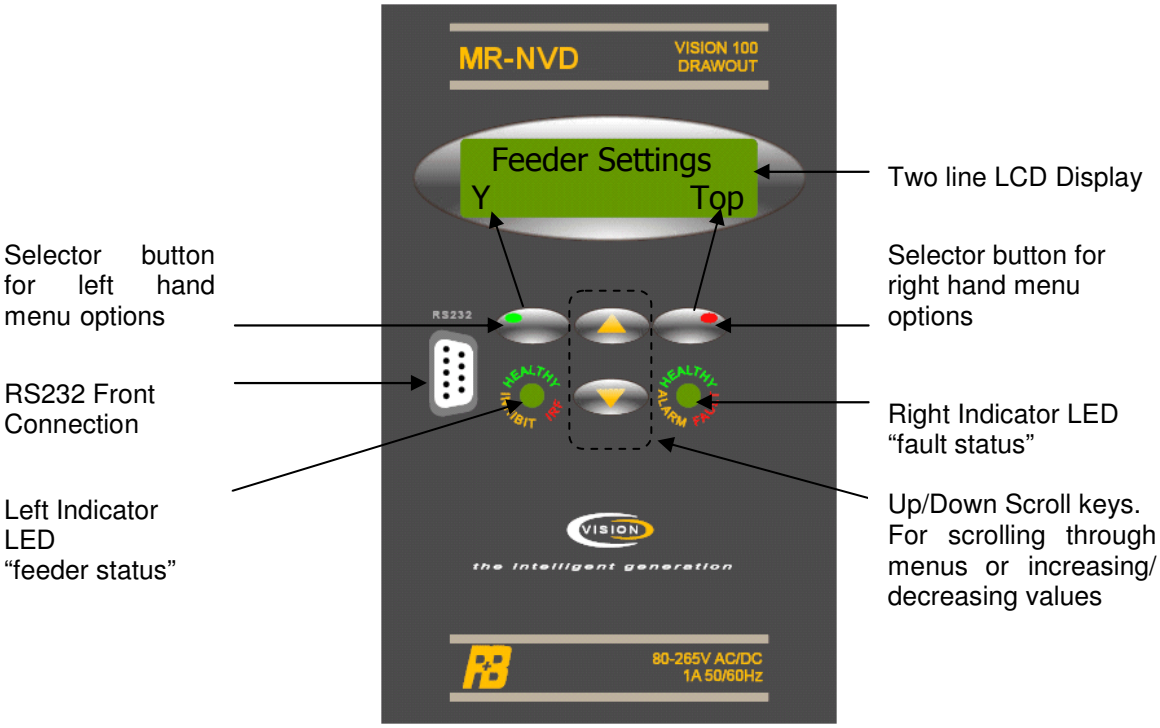
The front mounted RS232 port allows access to historical and running data without disturbing the rear RS485 network. This port can be used for direct programming.

5. Faceplate Functions.

The MR-NVD faceplate has been designed to provide an intuitive easy to use display allowing access to all the required information an operator would require.

This is achieved by using tri colour LED indications and a LCD display driven by 4 function keys.

The concept eliminates the need for additional indication devices on the front of the feeder panel such as Lamps, Ammeter, Voltmeter, Operations Counters, etc. Helping to reduce the overall cost of the panel and giving improved reliability by the reduction of separate components.



5.1 LED Status

The LED's operate as follows:

LED Colour	Left Hand LED – Feeder Status	Right Hand LED – Fault Status
GREEN	Healthy	Healthy
AMBER	Inhibit	Alarm
RED	IRF	Fault

6. LCD Display.

The MR-NVD's interface is fundamental to the philosophy of the Vision relay family of devices. The screen provides access to all dynamic and historical data and protection parameters.

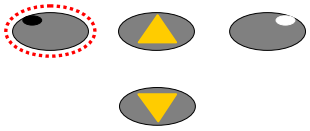
6.1. Menu Screens.

SV100 MR-NVD SW Version **x.xxx**	Vd 0.0V Hlth MENU

Upon power up the MR-NVD software version screen appears for a few seconds. The screen shows the software version and the unit type, which should be noted in all correspondence regarding the relay.

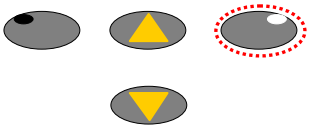
After the Introduction screen disappears then the initial display scroll page appears.

The four push buttons are used to navigate to areas of the menu structure.
Using these soft-keys provides for a very easy to use environment to effectively navigate the entire menu system.



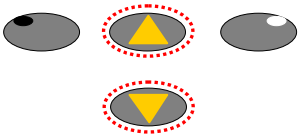
Any description in the LCD window appearing to the LEFT in CAPITALS can be selected using the left hand push button.

Any description in the LCD window appearing to the RIGHT in CAPITALS can be selected using the right hand push button.



Otherwise the bottom right hand portion of the LCD is reserved for displaying status messages; such as, ACTIVE FLT.

The centre push buttons are used to scroll the LCD window to display different menu prompts or data.



Whilst the MENU prompt remains to the bottom left portion of the LCD, the up and down push buttons can be used to select different pages of measured or status data, this is referred to as display scroll.

Any one of those display scroll pages can be selected as the default page, meaning if the unit is left in a sub menu – it would automatically return to the pre-selected page within the display scroll after an adjustable period of time

6.2. Display Scroll.

Examples of the Display Scroll screens.

Vd 0.0V Hlth MENU	DI1 OFF MENU	DI2 OFF MENU	Tr Over Voltage MENU RST
Al No Alarm MENU			

The <UP> and<DOWN> buttons will allow each of the above screens to be displayed in turn returning to the first screen and will loop continuously.

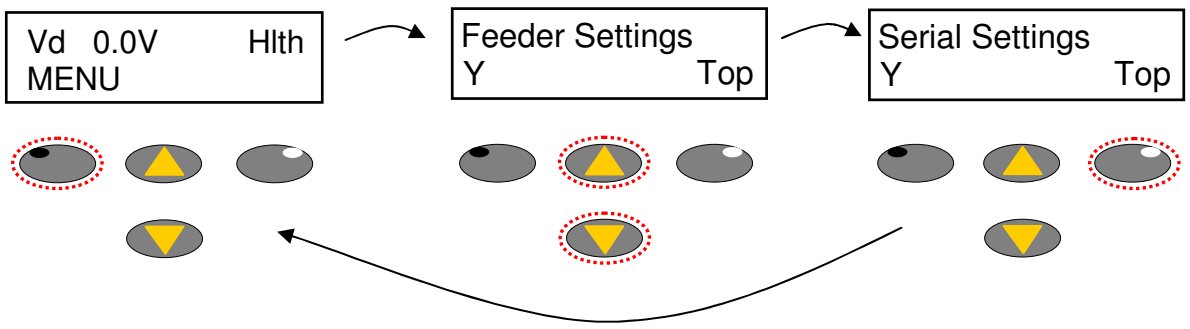
If a threshold is breached then the phase pick-up and function description will appear to the right hand portion of the display. The lower half right hand side of the display will show that the protective element has started to operate, <OVNVD PKUP>

If the relay pick-ups the right hand LED will pulse red at approximately once per second.
Should the threshold breach(s) clear before the alarm or trip timers have expired then the message will automatically clear and the LED will revert to its previous indication.

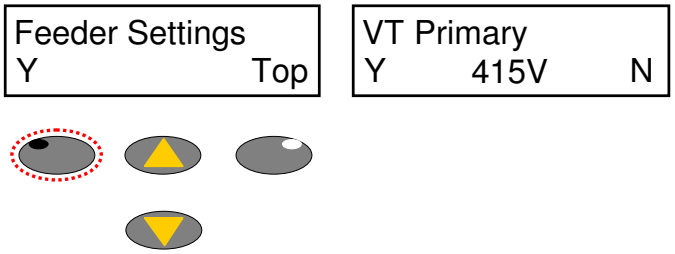
If a fault has occurred and subsequently cleared, then providing a panel reset has been configured the reset prompt will appear in the lower portion of the display to the right hand side, displayed as <RST>.

Selecting the <MENU> button allows access in to the sub menu and settings structure. The <UP> and <DOWN> buttons scroll through each sub menu heading.

The left button selects entry to each level. The right button <TOP> restores the screen to the display scroll and menu prompt.



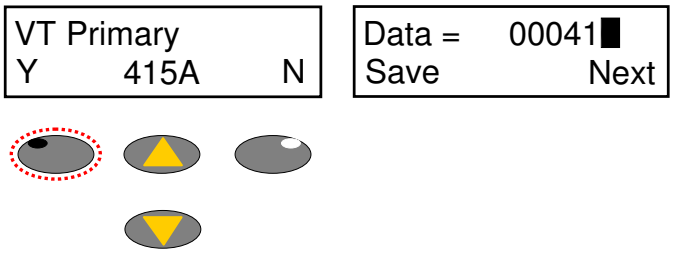
6.3. Feeder Settings.



This screen allows access to the Feeder Settings of the relay. The VT Primary, VT Secondary, Voltage can be viewed and set.

The list of values that are available to be changed can be scrolled through by pressing the UP and DOWN buttons.

A value can be selected to have its value changed by pressing the Y button when the value is highlighted. This then brings up the VALUE CHANGE SCREEN



The Value Change pop-up allows you to alter settings in specified steps within the minimum and maximum values of the particular setting range. The UP and DOWN arrow buttons are used to alter the value. The Next function is used to skip along to the next character.
Save is pressed to store the new value and exit.

If an undesired value is inserted incorrectly use the Next button to skip past the last character to the left. The Save option button now operates as a Discard to dump the new value without saving – reverting back to the original value on initial selection.

VT Primary.

This setting allows the user to program the primary rating of the voltage transformers on the supply phases. It is assumed that all phase transformers are of the same rating. The transformer should be chosen so that it is matched to the system voltage (often the phase to phase voltage) of the bus bars.

VT Secondary.

This setting allows the user to program the secondary rating of the voltage transformer.
Along with the VT primary it is these settings which determine the shown value on the LCD display.

Voltage.

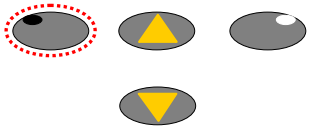
This setting allows the user to program the voltage of the system.
This setting is usually a root3 function of the VT Primary setting. The MR-NVD bases its thresholds from the Phase to Neutral measurement, whereas the VT Primary and Secondary produce a ph-ph expression of the voltage system.
The voltage level effective behaves as the nominal ‘pointer’ to which the threshold percentage levels of the protective functions are subsequently based.

6.4. Serial Settings.

Serial Settings	
Y	Top

Serial		
Y	Enabled	N

This screen allows the configuration of the communication ports.



Serial Enabled / Disabled.

This setting allows the user to enable the MR-NVD serial communications port. This setting must be set to 'Enable' if communication with the relay through any serial link is required.

Feeder Number.

This setting range 1 to 32, with a default setting of 1, identifies the MR-NVD unit to the Xcell unit (or any Master device connected to the Data highway) to which the RS485 port is connected. When updating firmware the auto program mode requires the drive number to be 1.

RS485 Baud Rate.

This setting allows the user to configure the appropriate communications baud rate such that the MR-NVD can communicate effectively on the Data Highway to which it is connected.

RS485 Protocol.

The RS485 serial communications port may be configured to operate using a slave implementation of Modbus RTU® or P&B Engineering's own protocol "P&B Standard".

RS485 Parity.

This setting allows the user to set the parity to match that of the host system on the serial link. The options are "Odd", "Even" and "None".

RS232 Baud Rate.

This setting allows the user to configure the baud rate for the front mounted RS232 port.

RS232 Protocol.

The RS232 serial communications port may be configured to operate using Modbus RTU® or P&B's own protocol "P&B Standard".

RS232 Parity.

This setting allows the user to set the parity to match that of the host system on the serial link. The options are "Odd", "Even" and "None".

Serial Delay.

The MR-NVD may be configured to respond to a request for information from the serial port instantly or after a designated delay.

A communications delay may be beneficial to ensure the Master device on the Data Highway receives all information sent back by the MR-NVD without enduring data collisions on the network.

Fast Scan 1 to 3.

A Fast Scan is a system used when operating in conjunction with the XCell Data Concentrator. As the XCell polls relays attached on its network, the fastscan settings allows the user to select important data to be read at a quicker rate.

The data on the communications link is broken into Fast Scan Data (or Process Critical Data) and Slow Scan or Full Read Data (Electrical Engineering Data).

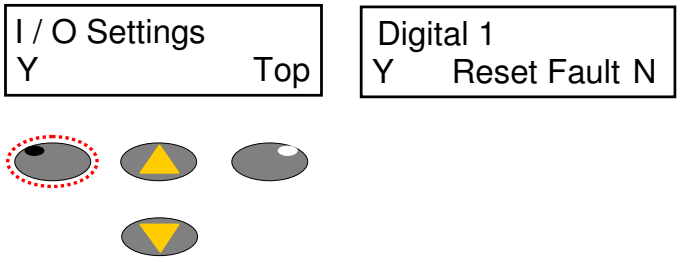
The configuration of Fast Scan is not necessary unless the MR-NVD in used in conjunction with the XCell unit.

Each Fast Scan number can be programmed to export important data when requested. This number references an internal address in MR-NVD and allows configurable data mapping between units. Typical data could be Average Phase Current, Motor Load and so on.

Max Scan Time.

This setting need only be used in order to limit the amount of data traffic on a RS485 network. Dynamic data can change rapidly, this setting allows the MR-NVD to limit the number of updates it makes to its Fast Scan values.

6.5. I/O Settings (Input / Output Settings).



The I / O settings are where the 2 digital inputs and 4 relay outputs are each assigned to a function.
Relay outputs can be assigned to the same function where as the digital inputs cannot.

If a digital input has previously been assigned it is removed from the list to prevent it being duplicated elsewhere.

6.5.1 Digital Inputs

The MR-NVD provide 2 digital inputs which can be configured to one of the functions described below. Otherwise the digital input defaults are Not Used.

Reset Fault.

This input enables the operator to reset MR-NVD Fault or Alarm conditions. The Input can only perform a reset if the following conditions are met:

1. The Protection Settings for the specific fault or alarm are set to allow remote resets.
2. The condition that caused the Fault or Alarm to occur no longer exists.

Block.

The Block Input can be used to block assigned protection functions, upon energising of the Digital Input. Each protection function has an option to enable the 'BLOCK' functionality. The block option must be configured in each of the protection functions where blocking of the function may be desired in for the blocking input to work.

If a function is configured to be blocked AND the digital input assigned as block is energised, then that function is prevented from taking its normal programmed action.

6.5.2 Relay Outputs

The MR-NVD provide 4 changeover contact relay outputs which can be configured to one of the functions described below. Otherwise the programmable relay output defaults are Not Used.

Trip.

If an output relay is assigned as 'Trip' then this relay will change from the de-energised to the energised state when triggered by any protection function that is configured to trip the relay.

Trip Fail Safe.

If an output relay is assigned as 'Trip FS' (Trip Failsafe) then this relay will change from the energised to the de-energised state when triggered by any protection function that is configured to trip the relay.

Alarm.

If an output relay is assigned as 'Alarm' then this relay will change state from de-energised to the energised relay contact when triggered by any protection function that is configured to alarm.

Alarm Fail Safe.

If an output relay is assigned as 'Alarm FS' then this relay will change state from energised to the de-energised relay contact when triggered by any protection function that is configured to alarm.

Healthy.

If an output relay is assigned as 'Healthy' this relay will be in its de-energised state at all times while the unit reports the motor as being healthy. This relay will be energised when the unit registers either an Alarm or Fault condition or the motor has been inhibited from starting.

Healthy Fail Safe.

If an output relay is assigned as 'Healthy FS' this relay will be in its energised state at all times while the unit reports the motor as being healthy. This relay will be de-energised when the unit registers either an Alarm or Fault condition or the motor has been inhibited from starting.

Internal Fail. "Intrnl Fail"

If an output relay is assigned as 'Intrnl Fail' this relay will energise if a hardware or software fault is detected by the MR-NVDs internal diagnostic functions or watchdog circuits.

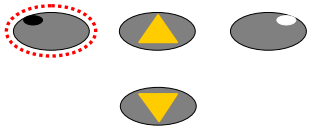
Serial Timeout. "Ser Timeout"

If an output relay is assigned as 'Ser Timeout' this relay will energise if the relay does not receive any data requests through the rear communication port

6.6. System Settings.

System Settings	
Y	Top

Password		
Y	ENABLED	N



This screen allows access to relay specific settings. Such as, password functionality, screen contrast settings etc and non categorised relay settings.

These settings and their functions are explained in detail below

Password.

If the password is set to enabled the default password (6363) may be used to change setting and reset statistical data. If the password has been changed then the new password must be used.

Change Password.

The MR-NVD default password is '6363'. It is recommended for security purposes this password be changed. The password may be up to 6 characters long and alphanumeric if desired.
If the User Password is lost and the Engineers Password has been disabled the only options to retrieve the password are to either read the information via the serial link or execute a Configuration Reset on the relay to restore all of the factory defaults.

Contrast and LCD Backlight.

These functions allow the user to change the display contrast and backlight levels.

Set Default Page / Default Return Time.

Any of the display scroll data pages can be nominated as the default page and returned to after a set period of key press inactivity.
To set the page; select the required page in the main display scroll menu then enter the system settings menu and select ‘set default page’.

Time Sync Delay.

The MR-NVD can be time synchronised by either, Chronovision which is a GPS based device which sits on the RS485 network and synchronises the time and date of each connected unit, or via broadcast command on the daisy chained RS485 modbus network. This delay prevents immediate updating of the Relay real time clock (RTC).

Software Version.

Displays the operating firmware loaded on to the unit. This should be noted along with the serial number when corresponding about this equipment

Serial Number.

Displays the Serial number of the Relay.

Smart Card Activation Key

In order for the smart card to operate a unique activation code is required to access hidden menu screens.

Time and Date.

These functions allow the user to set the date and the time on the relay.

Chronovision

When enabled allows the real time clock to be updated via the broadcast GPS sync signal from Chronovision.

Screen Saver and Screen Saver Time

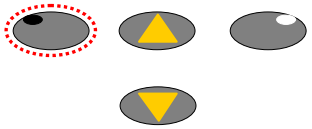
To help extend the life of the LCD we can power the display down if the application suits. The screen will power down after the set time from the last key press. The MR-NVD will still operate and can be remotely controlled via digital inputs or the serial interface.
On any key press or active fault the display will relight.

6.7. Protect Settings.

Protect Settings	
Y	Top

>Voltage Action		
Y	DISABLED	N

This sub menu allows the user to configure all of the protective settings:



DISPLAYED:	FULL DETAIL:
>Voltage	Over Voltage
>Volt	Over Voltage
Ser Tmout	Serial Timeout
Intnl Err	Internal Error

Each function can be set to Alarm and / or Trip and / or Block or left as an unused function, disabled. The resets for each are protective function are independently configurable as are the trip levels and trip times.

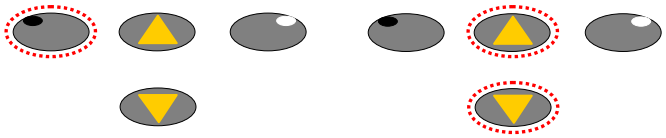
The protective function actions are as follows:

Disabled	Protection Disabled
Alarm	Alarm Enabled
Trip	Trip Enabled
Alarm & Trip	Alarm & Trip Enabled
Block	Block Enabled
Alrm & Blck	Alarm & Block Enabled
Trip & Blck	Trip & Block Enabled
A&T&B	Alarm, Trip and Block Enabled

> Voltage Reset		
Y	DISABLED	N

DATA=DISABLED	
Save	Discard

The reset options are as follows;
Using the UP and DOWN keys the data can be changed to one of the following;



Panel	Panel reset only
Serial	Serial reset only
S P	Serial or Panel reset
Remote	Remote reset only
R P	Remote or Panel reset
R S	Remote or Serial reset
R S P	Remote or Serial or Panel reset
AUTO	Auto reset

Each protection function is configurable independently of the others. The available action, the type of reset, the various threshold levels and trip timers for each and every protection function can be found in section 8.
This section describes in detail what each function does and how it operates.

Function.

If a particular function is required for a protective use it should be selected and set to the required action.
If a particular function is not required it should be left disabled. The display will show DISABLED next to the function name. If a function is disabled then the threshold level and trip times will not impact the activity of the relay.

Alarm.

An Alarm is considered as a high level function. If the function activates it will be recorded as part of the alarm history and cause MR-NVD to enter an alarm state; the alarm fault will be displayed in the main display scroll page and the right hand LED will give an alarm indication (amber colour).
If an output relay is set as Alarm it will change state with the fault.

Trip.

A Trip is considered as a high level function. If the function activates it will be recorded as part of the trip history and cause the MR-NVD to enter a trip state; the fault will be displayed in the active faults page and the unit will automatically display that page, the right hand LED will give a Trip indication (red colour).
If an output relay is set as Trip it will change state with the fault.

Block.

In order for block to operate the function must be configured and a digital input also assigned as block. When the digital input is energised this will prevent the protective function from operating against breach of threshold and trip time.

Reset.

The configuration of the reset allows that particular protection function to be cleared or reset to a healthy condition providing the condition that caused the fault, alarm or inhibit has been removed.

Auto-Reset.

This option, when enabled, automatically resets the fault when the situation that caused the trip has been removed. If Auto Reset is selected the other reset options are not required.

Panel-Reset.

This option, when Enabled, allows a reset of a fault to be carried out from the front panel of the relay. A reset button will be displayed in the top right hand corner of the main display scroll page, if any fault has been removed and is enabled for a panel reset.

Serial-Reset.

This option, when Enabled, allows a reset of a fault to be carried out through the serial communication port of the relay.

Remote-Reset.

This option, when Enabled, allows a reset of a fault to be carried out through a digital input to the relay. A digital input must be set to Reset Faults and must be closed after the fault condition has been removed in order for the reset to operate.

6.7.1. Neutral Voltage Displacement (over voltage).

The MR-NVD may be configured to trip, alarm and/or indicate as a result of a neutral voltage displacement condition. The over voltage action will occur when the measured phase increases above the trip level.

Trip Level.

The trip level is set as a percentage of the Voltage. If the measured voltage in any phases decreases and remains below the threshold level action is taken after the trip time has elapsed.

Trip Time.

The trip time is set to determine how long an undervoltage condition can persist before the configured action is taken.

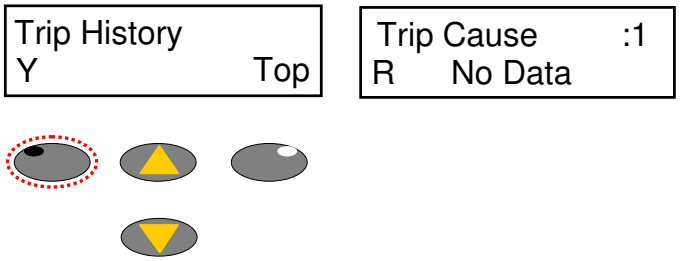
6.7.6. Serial Timeout.

For a set period of inactivity on the rear communication port the unit can be configured to take some action in the event.
It is worth noting that the MR-NVD device is slave to any host system, the unit will not send information via the serial port unless it has been requested by a master device.

6.7.7. Internal Error.

The MR-NVD incorporates an internal software and hardware watchdog feature to monitor the integrity of both on board hardware and software systems. This feature may be configured to indicate as a result of any registered problems. If a problem with the hardware or software is located during the error check routines the MR-NVD will generate an error code (or diagnostic status).

6.8. Trip History.

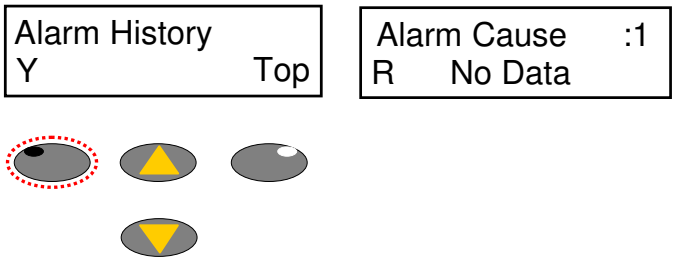


This screen allows access to the relays Trip History data.
Upto 32 Trip events can be registered in this menu screen, starting with the most recent to last available (32nd most recent trip).
Each event record contains the Trip Cause, the Trip Time and Trip Date.

The up and down pushbuttons allow each trip record to be scrolled through. In the left hand corner of the LCD a letter 'R' is shown, this allows the reset (deleting) of individual trip events.

To reset a particular event scroll through the available trip records until the event you require is reached, then press the left hand pushbutton under the letter 'R' shown on the LCD. The trip event will now be reset. Only press this once otherwise multiple events could be accidentally reset with continual pressing, each trip record will take a few seconds to delete and update on the LCD.

6.9. Alarm History.

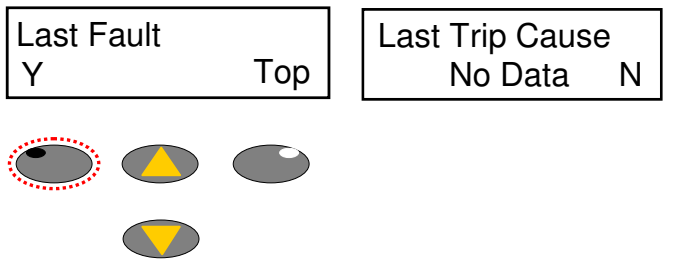


This screen allows access to the relays Alarm History data.
Upto 32 Alarm events can be registered in this menu screen, starting with the most recent to last available (32nd most recent alarm).
Each event record contains the Alarm Cause, the Alarm Time and Alarm Date.

The up and down pushbuttons allow each trip record to be scrolled through. In the left hand corner of the LCD a letter 'R' is shown, this allows the reset (deleting) of individual alarm events.

To reset a particular event scroll through the available alarm records until the event you require is reached, then press the left hand pushbutton under the letter 'R' shown on the LCD. The alarm event will now be reset. Only press this once otherwise multiple events could be accidentally reset with continual pressing, each alarm record will take a few seconds to delete and update on the LCD.

6.10. Last Fault.

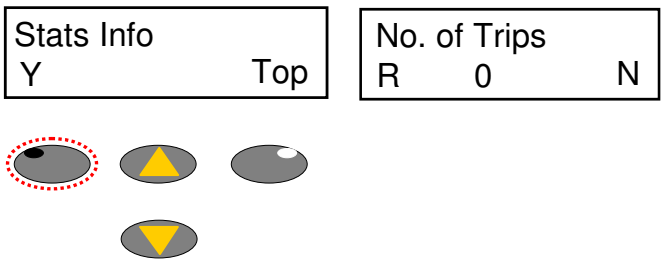


This screen allows access to the relays last fault data information. This will be the most recent trip and alarm events. Information given in this screen is more detailed than that of the Alarm and Trip History pages. To scroll through the available data use the up and down pushbuttons on the frontplate of the relay. The information provided for both last trip and last alarm is as follows:

Trip Cause	Alarm Cause
Trip Time	Alarm Time
Trip Date	Alarm Date
Trip Vd Value	Alarm Vd Value

6.11. Stats Info.

If the Password is set to enabled, the password will be requested here to allow access to this menu.



This screen allows access to relays statistical information.
To scroll through the available data use the up and down pushbuttons on the frontplate of the relay.

In the left hand corner of the LCD a letter 'R' is shown, this allows the reset (deleting) of individual statistical values.

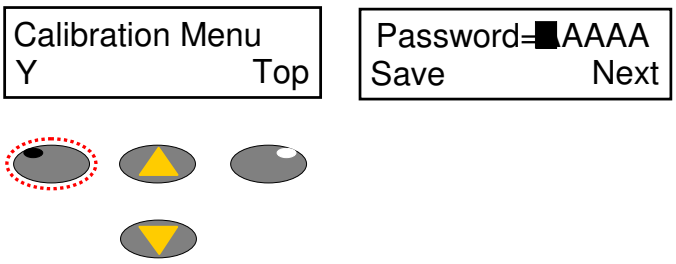
Statistical information available in this menu is as follows:

No. of Trips	Number of Trips (total)

6.12. Calibration Menu.

The calibration menu should not be entered unless it is absolutely necessary to do so.
Any inadvertent settings made here may compromise the accuracy of the unit and its ability to trip.

If the Password is set to enabled, the password will be requested here to allow access to this menu.



The gain and offset values for each of the analogue channels can be adjusted. Auto calibration routines can also be performed.

Each unit is calibrated prior to dispatch and a signed test report is issued. The user may however access these settings if required and re-calibrate the device if deemed necessary.

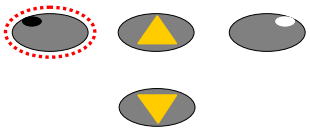
In addition to the calibration of analogue inputs the Calibration Sub Menu provides some useful diagnostic tools.
After entering the password the Calibration Sub Menu will be displayed and allows access to the following settings:

Gain and Offsets for each analogue channel.	Typically a gain value is between 900 to 1200
Auto Vd Cal	With injected Vd phase voltage, the channels can be calibrated
Reset Cal Factors	Reset the calibration to default, gain=1024
Run Offset Cal	Without any injected input, this sets all channels to 0.
Digital Inputs	Check of the binary digital input status
O/P Relay Tests	Output relays can be forced to changed state
Noise Check	View the noise level readings per channel
System Frequency	Corresponds the relay to the frequency of the measured system.
Feeder Type	Changes and selects the function type of the relay.

6.13. Smart Card Settings (OPTIONAL).

Smart Card Menu	
Y	Top

Card Type		
Y	Setting	N



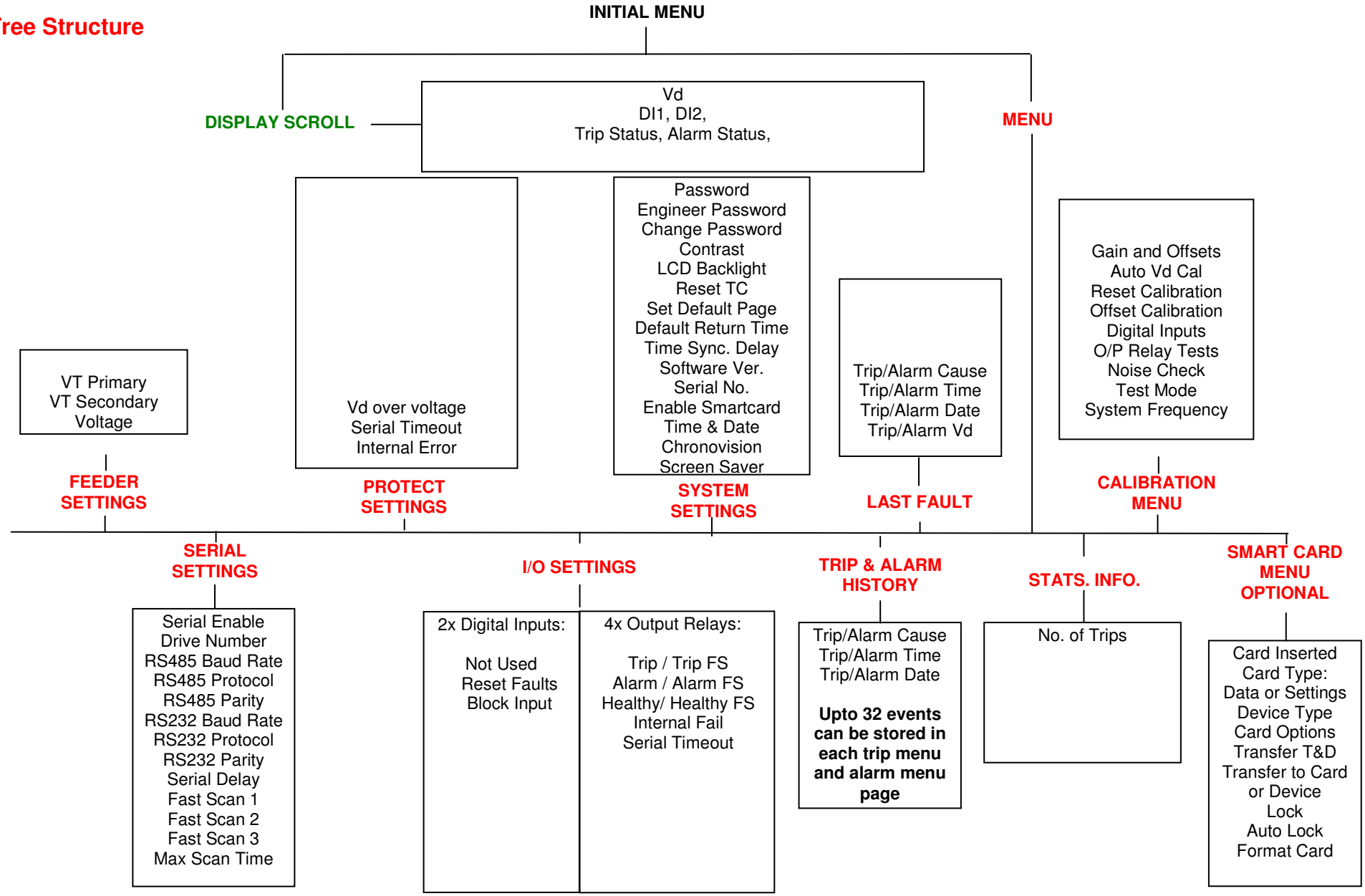
The Smart Card is a removable eeprom memory card which can be supplied with the MR-NVD on request.

An activation code is required to access this menu system in order to allow full manipulation of the card.

The activation code is programmed in the System Settings, Enable Smart Card option.

The Smart Card can be used for parameter storage and for cloning like drives or it can be formatted as an extended data card which will log and store events.

7. Menu Tree Structure



8.1. MR-NVD System Settings Summary.

	Range	Step	Default	User Setting
Serial Settings				
Serial	Enabled / Disabled		Enabled	
Drive Number	1-32	1	1	
RS485 Baud Rate	9600/19200/38400		9600	
RS485 Serial Protocol	Modbus / P&B / P&B Inv		P&B	
RS485 Parity	Even / Odd / None		Even	
RS232 Baud Rate	4800/9600		4800	
RS232 Serial Protocol	Modbus / P&B / P&B Inv		P&B	
RS232 Parity	Even / Odd / None		Even	
Serial Delay	1ms-20ms	1ms	1ms	
Fastscan 1	0-255	2	0	
Fastscan 2	0-255	2	0	
Fastscan 3	0-255	2	0	
Max Scan Time	1-30s	1s	1s	
Motor Settings				
VT Primary	100-33000V	5V	415V	
VT Secondary	100-415V	1V	100V	
Voltage	50%-150% of Primary	5V	100% (415V)	
System Settings				
Password	Enabled / Disabled		Disabled	
Engineering Password	Enabled / Disabled		Enabled	
Change Password	5 Characters		6363	
LCD Contrast				
LCD Backlight				
Default Return Time	No Return (Off) 1-5min	1min	1min	
Time Sync Delay	0-2000ms	1ms	0ms	
Software Version	X.XXX			
Serial Number	XXXXXX			
Enable Smart Card	XXXXXX			
Time	XX:XX:XX			
Date	XX/XX/XX			
Chronovision	Enabled / Disabled		Disabled	
LCD Scrn Saver	Enabled / Disabled		Disabled	
LCD Scrn Saver Time	60-3600s	1s	3600s	

8.2. MR-NVD Control Setting Summary.

	Range	Step	Default	User Setting
Digital Inputs				
Dig_In 1	Not Used / Reset / Block /		Not Used	
Dig_In 2	Not Used / Reset / Block /		Not Used	
Relay Outputs				
Relay 1	Trip		Trip	
Relay 2	Programmable		Not Used	
Relay 3	Programmable		Not Used	
Relay 4	Programmable		Not Used	

8.3. MR-NVD Protection Setting Summary.

● Selectable
■ Fixed

ANSI No.	Protective Function	Available Action: Trip	Alarm	Block	Available Reset: Auto	Panel	Serial	Remote	Variable	Range	Step
59NVD	Over Voltage	●	●	●	●	●	●	●	Trip Level Trip Time	1-100% 0.05-60s	1% 0.01s
	Serial Timeout	●	●	●	●	●	●	●	Timeout In	5-120	1s
	Internal Error	●	●	●	●	●	●	●			

8.4. MR-NVD Blank Protection Setting Summary.

● Selectable
■ Fixed

ANSI No.	Protective Function	Available Action: Trip	Alarm	Block	Available Reset: Auto	Panel	Serial	Remote	Variable	User Setting
59NVD	Over Voltage								Trip Level Trip Time	
	Serial Timeout								Timeout In	
	Internal Error									

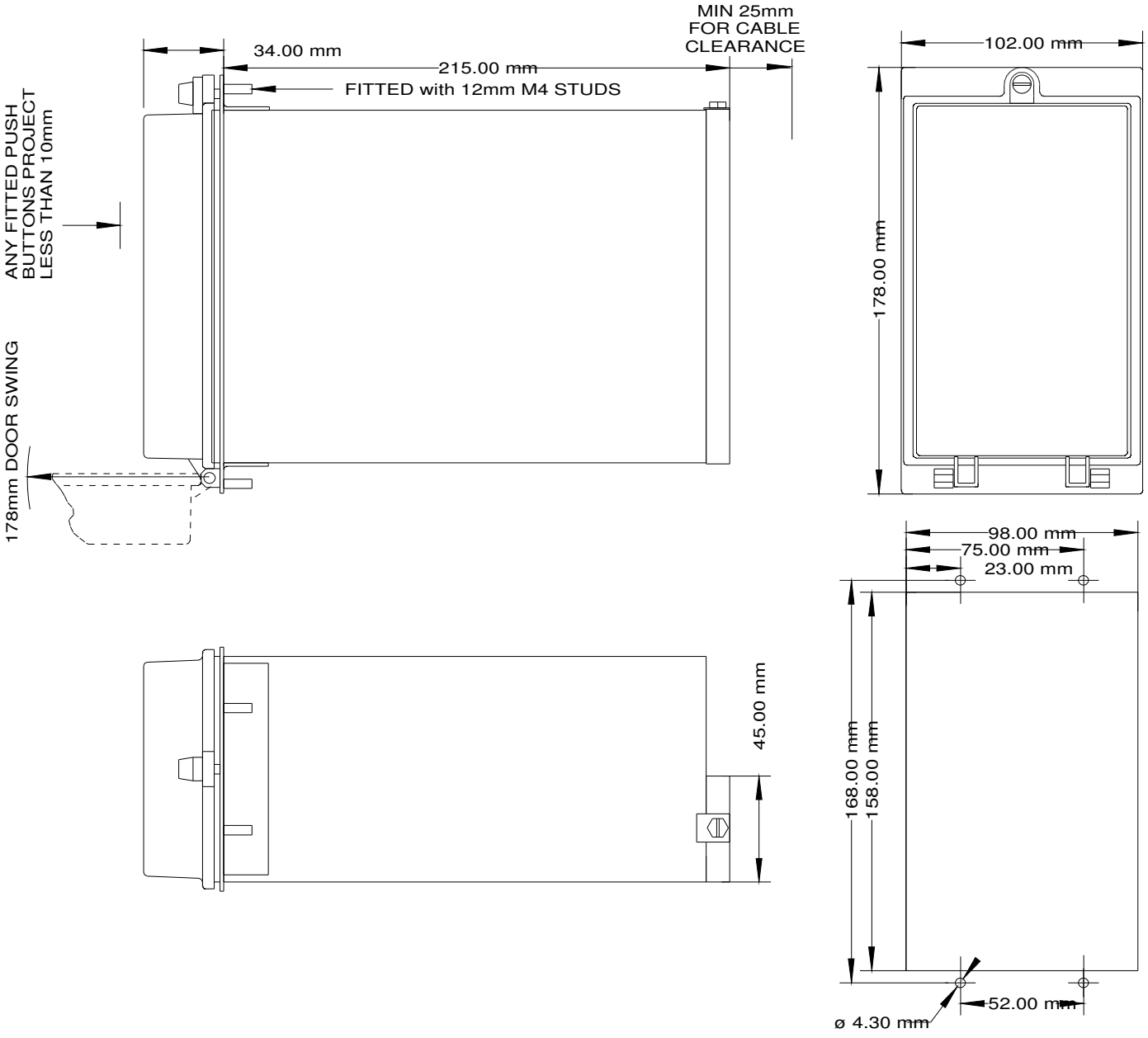
Appendix 1

MR-NVD Installation.

The MR-NVD is supplied in a withdrawable case suitable for flush mounting as detailed below. The control and CT cable should be stranded copper core of 0.5 to 2.5mm^2.

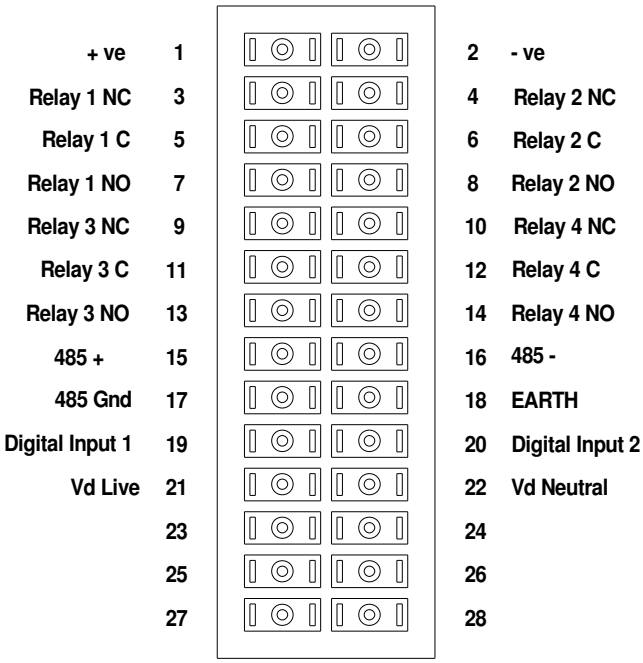
The rear terminal block accepts both pre-insulated screw and push on blade type connectors. Each terminal having 1x M4 screw type and 2x 4.8mm blade type complying BS5057.

Wiring torque of M4 screw should not exceed : 0.5 – 0.6 Nm
The MR-NVD has been designed for installation on to open type panels, for use on the flat surface of a type 1 enclosure and for installations where the ambient temperature does not exceed 60^0 C.



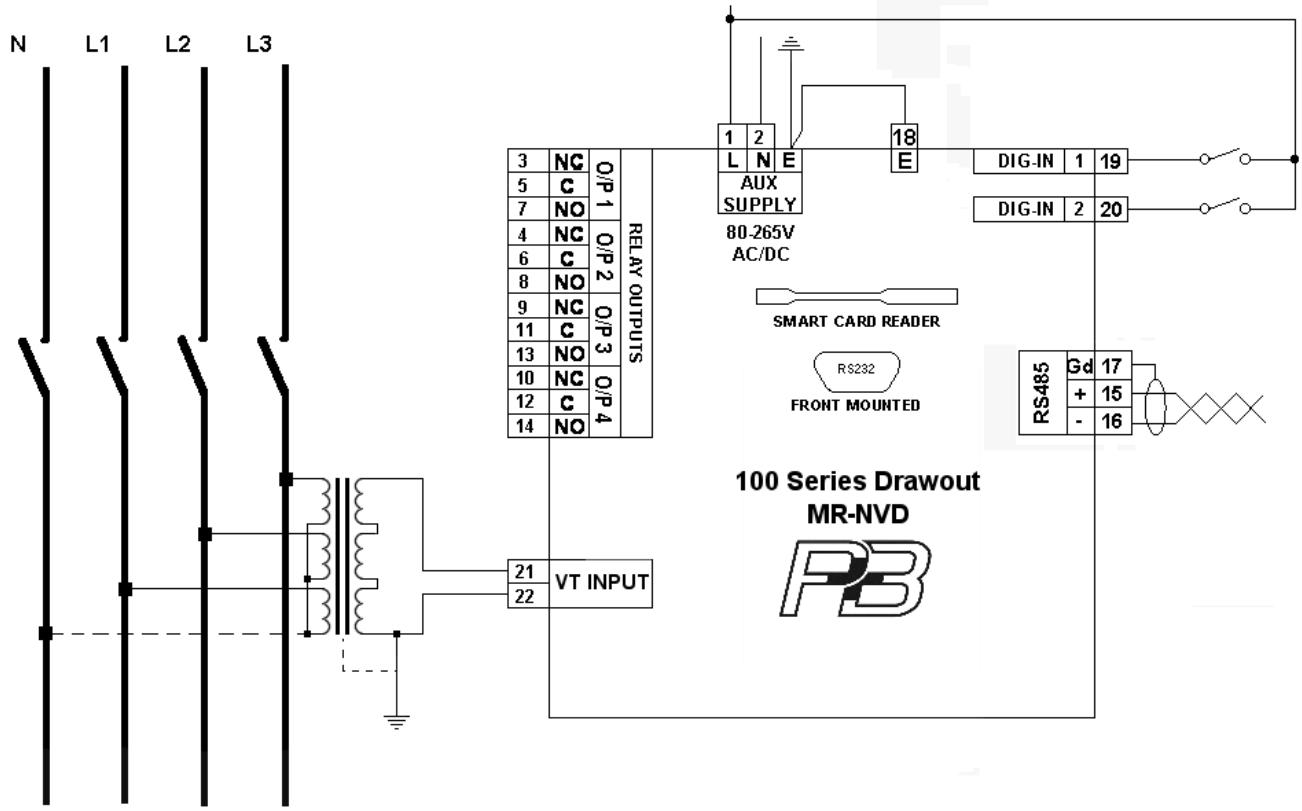
Appendix 2

Termination Numbers.



Appendix 3

MR-NVD Schematic Diagrams.



Conventional Voltage Transformers with suitable secondary rating are common and can be connected directly to the VT inputs of MR-NVD.

Regardless whether single or a tri phase VT is used, the relay should be connected as an open delta formation.

Appendix 4

Handling Guidelines.

Installation.

Protection relaying equipment should be installed, commissioned and programmed by professional engineers familiar with such products. P&B cannot be held liable if proper handling is not observed.

The relay is programmed to the factory default settings upon shipment and must be programmed correctly to achieve safe and satisfactory protection of the equipment.

Changes to the relay hardware and or software may affect the calibration of the unit and its measurement accuracy should be checked prior to reinstating the product in service. If unsure, contact P&B for advice.

Disposal.

P&B are committed to manufacturing practices which do not result in pollution or cause damage to the environment.

As the MR-NVD contains a non rechargeable battery we would recommend safe disposal of equipment at the end of its life inline with local laws.

If you wish us to dispose of equipment on your behalf we are able to provide such services.

Caution, battery may explode if mistreated.
Do not recharge, disassemble or dispose of in fire.

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