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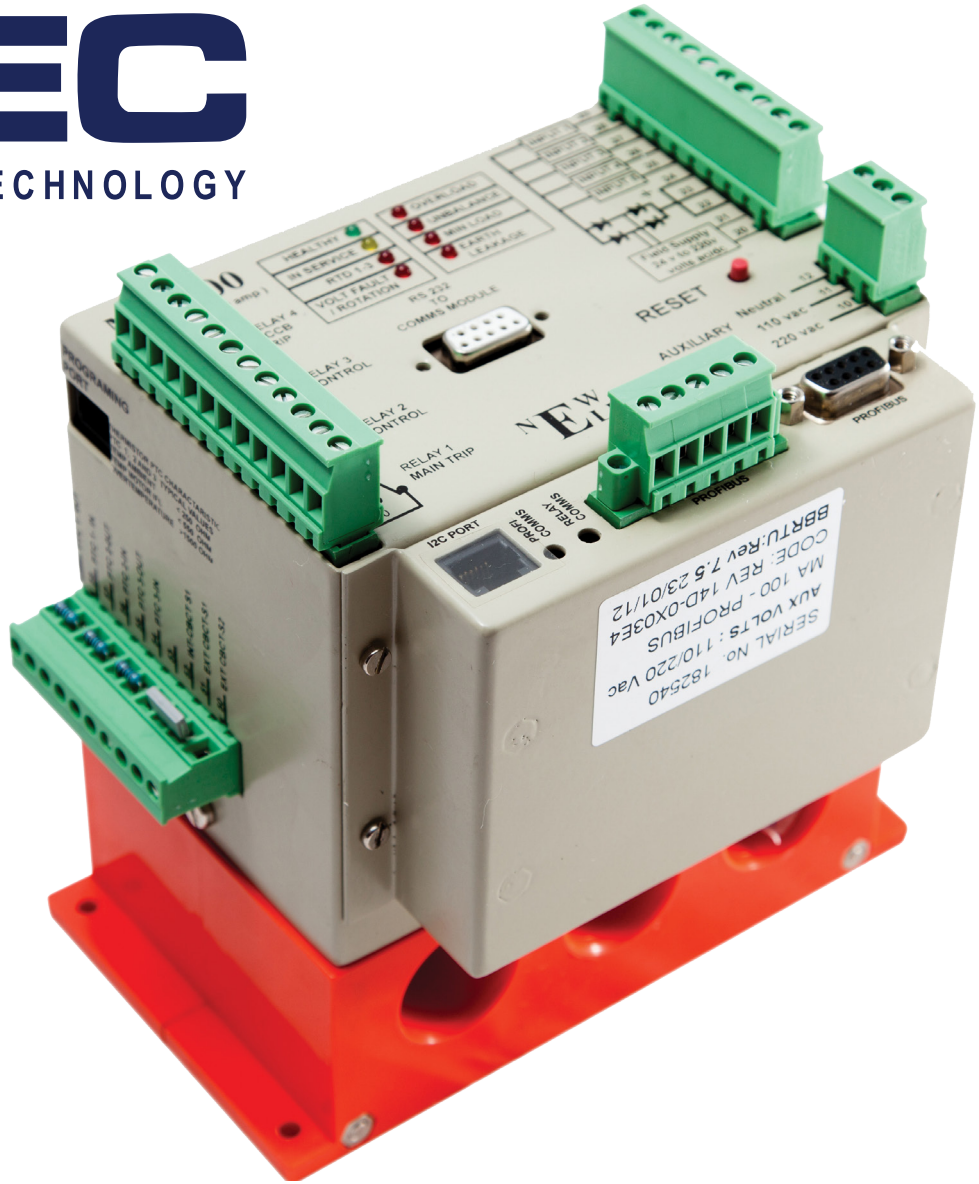
MOTOR PROTECTION & CONTROL TECHNOLOGY

MA Motor Protection Relay...



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ISO 9001:2008
ISOQAR QUALITY ASSURED ISO 9001
UKAS QUALITY MANAGEMENT 026
Certificate Number : 8707QMS001

Physical Address: 298 Soutter Street, Pretoria West
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www.newelec.co.za sales@newelec.co.za

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Innovative solutions from South Africa's Leading Motor Protection Specialists

About NewElec

NewElec designs and manufactures a wide range of superior electronic motor protection relays for both local and International markets. NewElec's goal, for the past 38 years, has been to exceed the expectations of every client by OFFERING quality products, outstanding customer service and greater value, thus optimizing system functionality and improved operational efficiency.

As experts in motor protection, NewElec is involved in every stage of the client's selection of the required protection relay offering ongoing functional and technical support. Our R&D division is continually designing the most up to date motor protection products to meet customer requirements.

NewElec's electronic motor protection relays can be found in refineries, mining, steel, petrochemical, pulp and paper, sugar mills, agriculture and material handling industries to name a few, both locally and internationally. The NewElec product range includes software programmable LV motor protection relays for process control applications, protection relays for LV and MV motors, relays for pump motor protection, as well as earth leakage protection relays.

NewElec is continually expanding and has recently installed a manufacturing division for its relay housings. This ensures that the final product meets NewElec's precise requirements.

With headquarters in Pretoria West, Gauteng, South Africa, NewElec was established in May 1978 and is accredited with ISO 9002.

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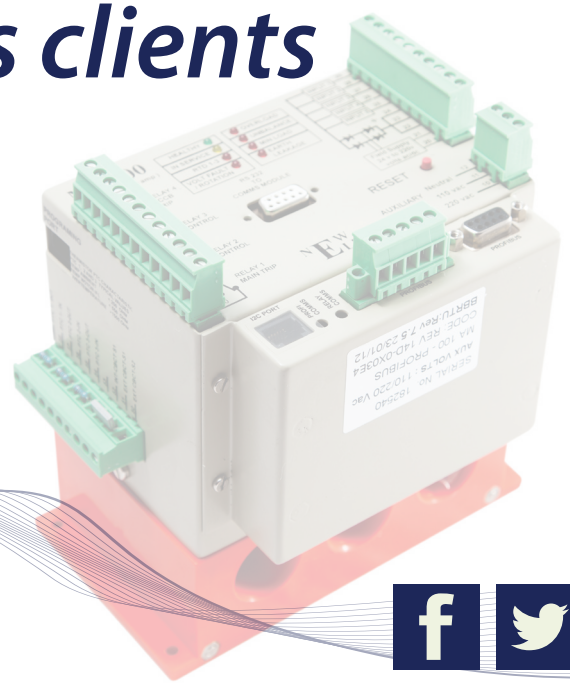
NewElec has bundled a number of excellent PROTECTION features into ONE single product so as to optimize benefits to its clients



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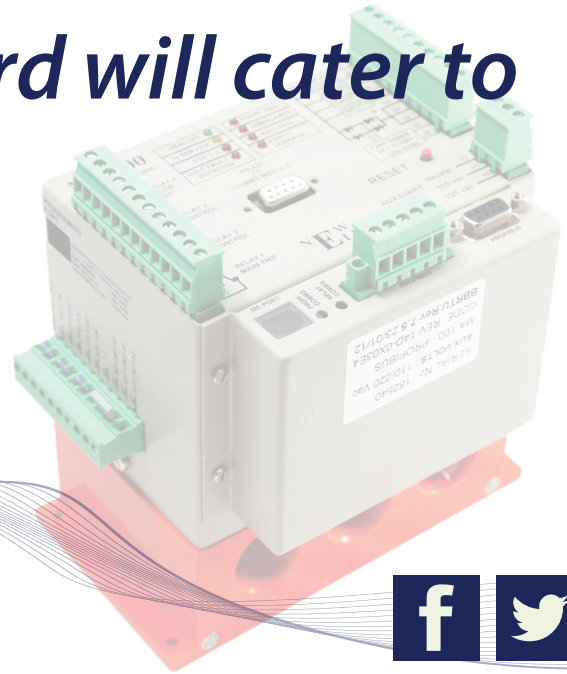
Flexible Communications Protocols

- *As an added benefit, a separate optional screw fastened communications tray is available for FIELD BUS preferred protocols.*
- *We presently cater for Profibus DP, Modbus and Canbus, while a third party interface card will cater to Device Net.*
- *Additional protocols being developed*



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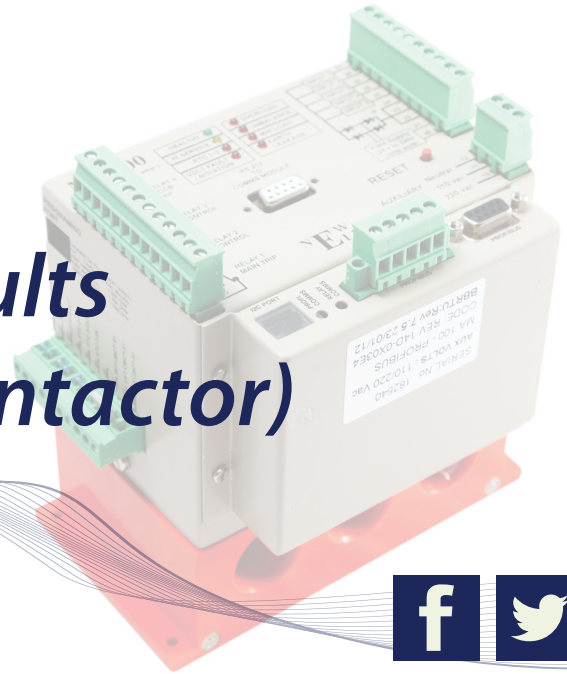
Looking at WHAT CAN go Wrong!

- *Overloading of the motor*
- *Phase unbalance and failure*
- *Bearing failures*
- *Earth leakage and earth faults*
- *Short circuit related faults*
- *Load loss especially with pumps*
- *Over / undervoltage, phase rotation faults*
- *Main contactor fails to open (Frozen contactor)*
- *General OVER temperature*



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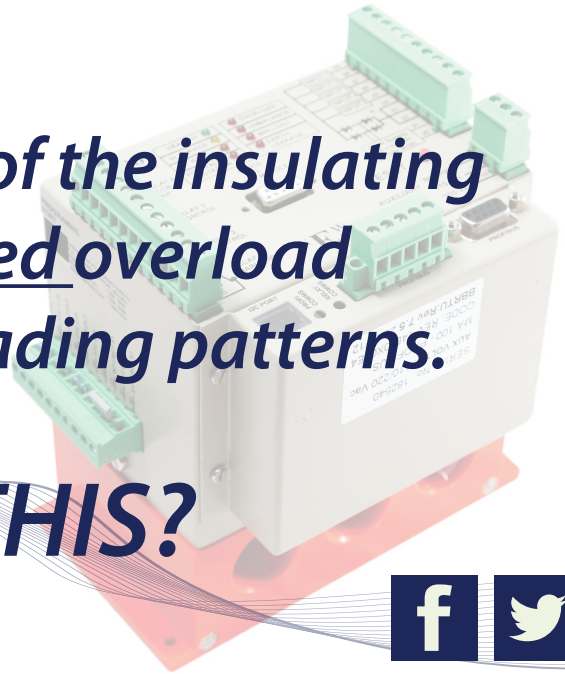
OVERLOADING OF THE MOTOR

Overloading of motors eventually results in insulation failure. This seldom happens suddenly and is caused by overloading of the motor to a point where the temperature rise as a result of the overloading is above the safe operating temperature of the insulating material.



Note further, that the resulting over temperature of the insulating material need not of necessity be due to a sustained overload condition BUT that it may arise from cyclic overloading patterns.

SO HOW DO WE PREVENT THIS?

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PREVENTING OVERLOADING OF THE MOTOR

We need to know more about the temperature limitations of the insulating materials used

We need to find out about how efficiently the motors are capable of dissipating heat

THE INSULATION CLASS

THE THERMAL CLASS

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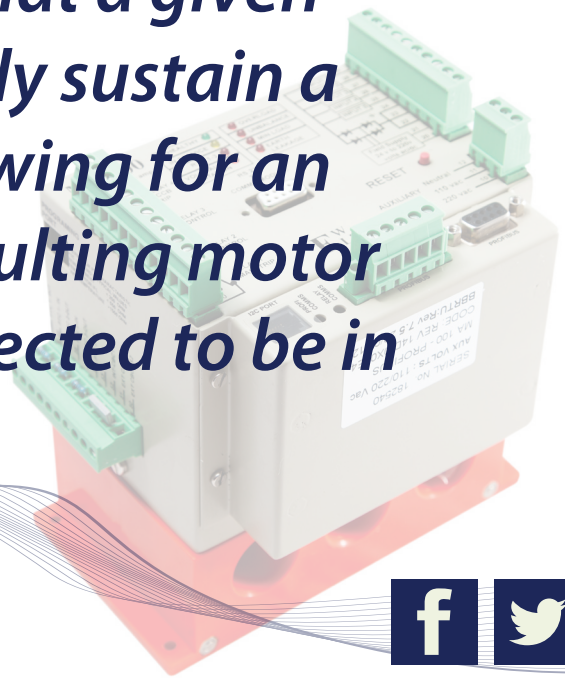
Motor Windings Insulation Class

Most standard continuously rated S1 TEFC motors manufactured in South Africa have a temperature rise specification for class B insulation but are insulated with CLASS F insulating materials. This implies that a given motor during full load operation will typically sustain a temperature rise of some 80 degrees C. Allowing for an ambient temperature of 40 degrees C, the resulting motor temperature when running fully loaded is expected to be in the region of 120 degrees C.



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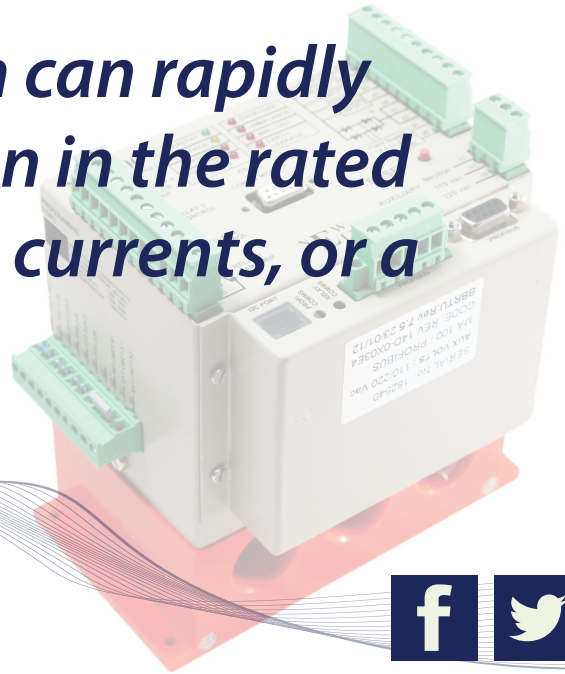
Motor Windings Insulation Class

As insulation Class F materials are adequate for temperatures up to 155 degrees C the apparent over capacity in temperature is in the region of 30-35 degrees C.

This would seem satisfactory BUT this margin can rapidly be absorbed by a 15% overload, a 5% reduction in the rated supply voltage or a 3% unbalance in the phase currents, or a combination of these.



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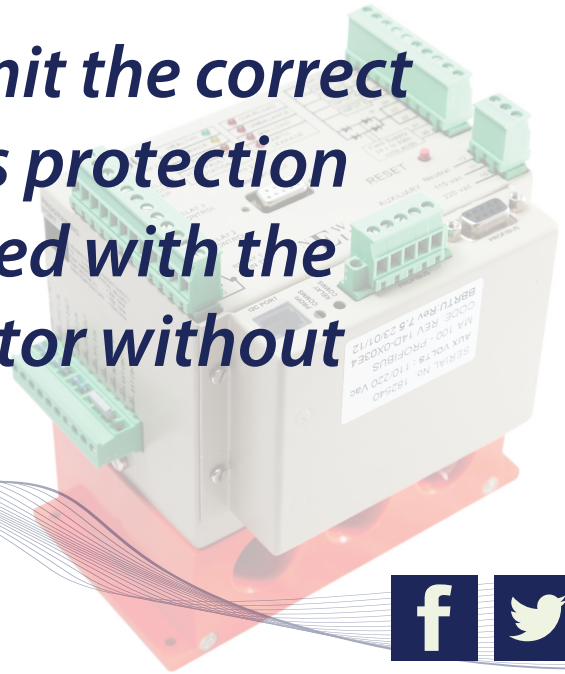
The Motor Thermal Class

Motor manufacturers provide us with SAFE COLD and HOT STALL times. These provide us with effective information on the motor's ability to dissipate heat.

As such good motor protection relays will permit the correct selection of the thermal curve class within its protection ambits. This selection when correctly matched with the motor will permit optimal loading of the motor without nuisance trips!



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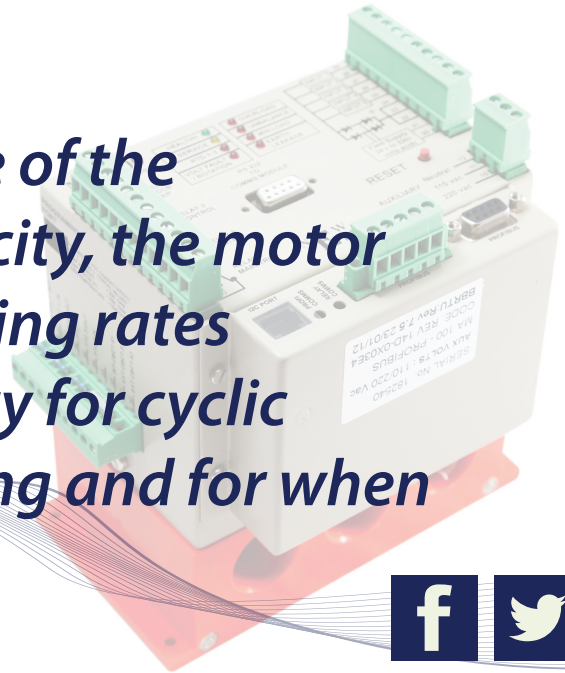
Putting It All Together

Your motors NEVER need be overloaded to the point where the insulating material temperature is compromised! The ideal balance is full use of your motor kW output BUT within its thermal envelope.

We achieve this by means of:

1. *Designing a thermal model that takes cognisance of the insulating material class, the motor full load capacity, the motor thermal curve class and accommodating two cooling rates into the thermal model used. The latter is necessary for cyclic overloading demands on the motor prior to tripping and for when a motor is stationary after a trip condition.*



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Putting It All Together contd.

2. *Providing pre-loaded curves*
3. *Protecting the motor against locked rotor on start up (Based on the selected motor thermal curve class)*
4. *Providing a user-selectable running stall or JAM protection feature which automatically asserts itself as soon as the motor has started. This feature protects mechanical components attached to the motor output shaft from impact loads as a result of over torque situations.*
5. *A thermal model that calculates motor heat build up as soon as the motor is 2% overloaded*
6. *Ensuring a fast, safe BUT not fixed cooling time when the motor has been overloaded which can only be overridden by a supervisor*
7. *Equipping the relay with active thermal memory*

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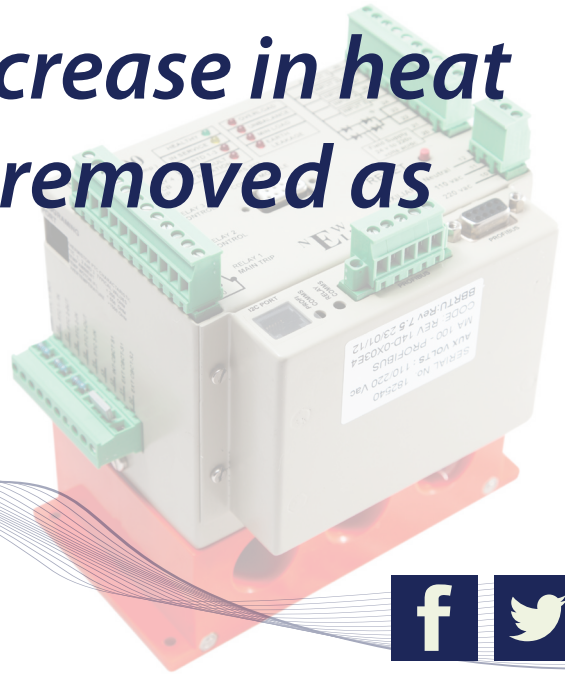
Phase Unbalance & Phase Loss Protection

- *The heating effects of unbalanced loads is detrimental to the motor winding insulation and as such should be carefully monitored*

- *A phase loss will result in a very rapid increase in heat so that the supply to the motor must be removed as fast as possible*



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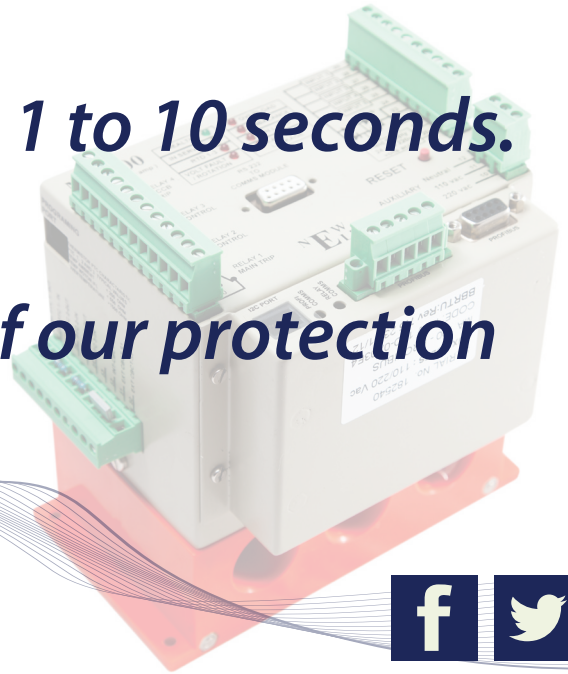
How Do We Protect Against Phase Unbalance and Phase Losses?

After checking the "actual" on site inherent unbalance level the user is invited to set the unbalance sensing threshold from 5 to 50 % between phases.

The unbalance trip delay is user adjustable from 1 to 10 seconds.

A phase loss will result in the main trip contact of our protection relay being energised in 1 second.



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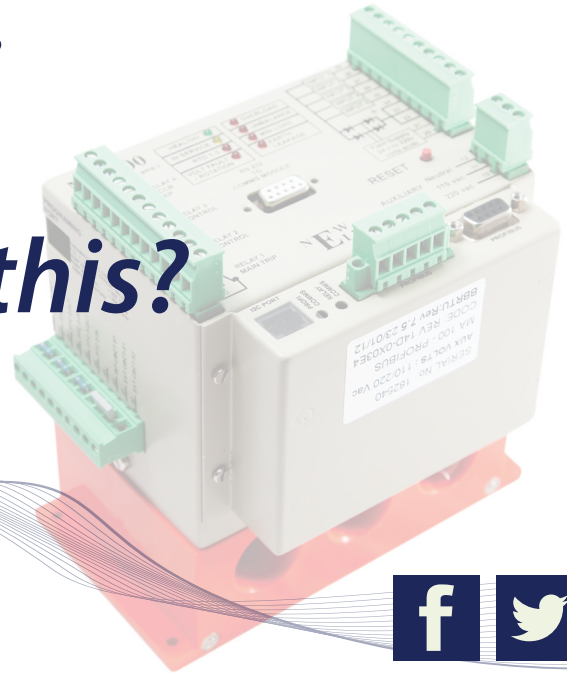
Bearing Failure

The failure of bearings frequently contribute to sudden motor failure. This usually is of a severe nature and caused by the rotor chaffing against the stator due to bearing wear and rotor shaft misalignment.

How do we protect against this?



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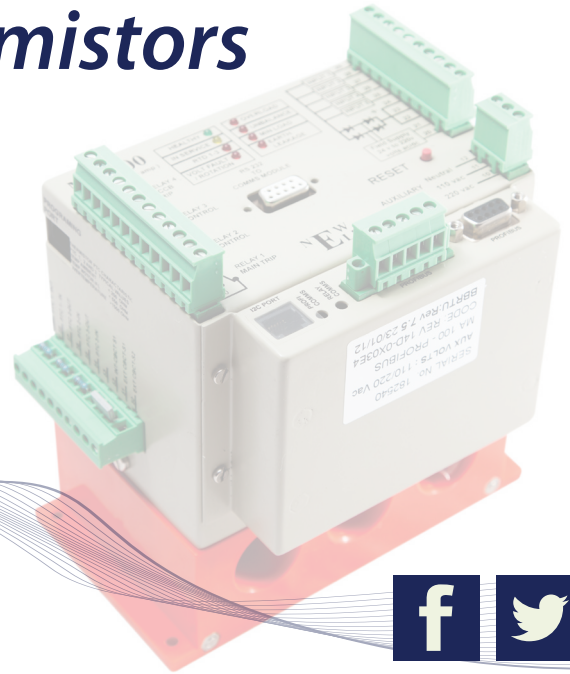
Bearing Failures

- *Our new relays are equipped with three thermistor PTC 100 inputs*
- *This permits two dedicated over temperature protection circuits for each drive end bearing*
- *The third circuit will accommodate thermistors imbedded in the stator windings*



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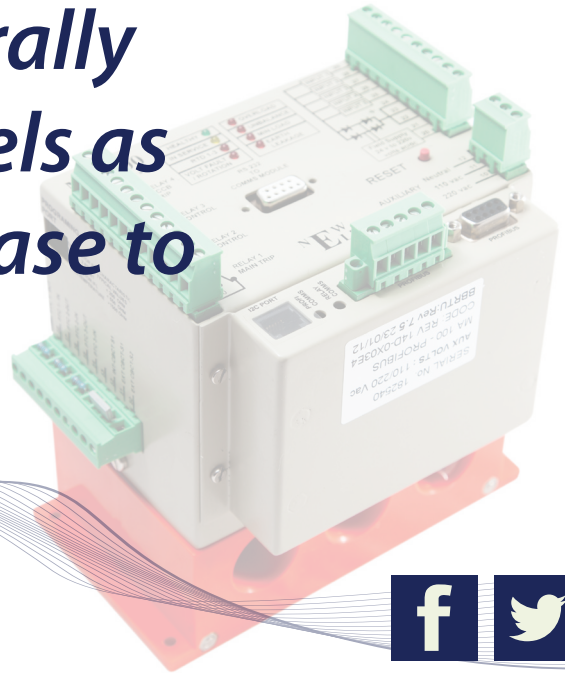
Earth Leakage & Earth Fault Protection

- *When motors are used on a seasonal basis and exposed to high humidity conditions earth leakage faults can develop*

- *Earth faults are more serious and generally associated with higher fault current levels as would be the case, for example, on a phase to earth condition*



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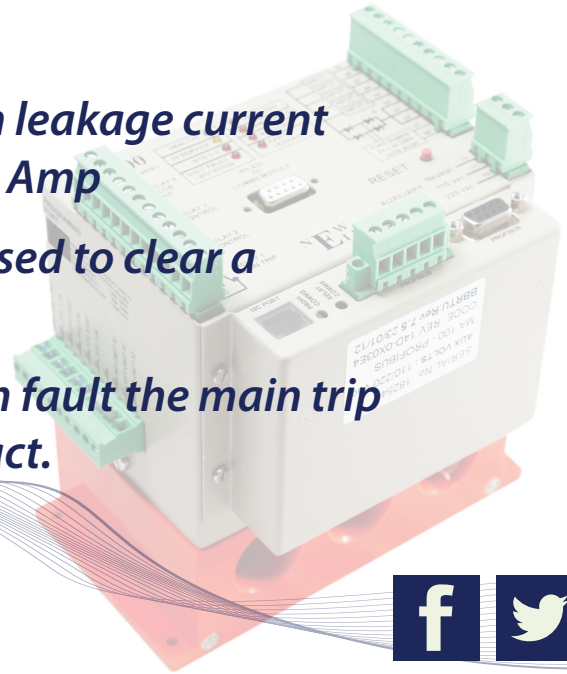
How Do We Protect Against Earth Leakage And Earth Fault Conditions?

- *NewElec has included two pre-programmed output contacts designed to ensure proper trip co-ordination when detecting such faults*
- *The MAIN trip contact will energise when the earth leakage fault current is less than 1 Amp. The earth leakage detection threshold is user-selectable from 50 mA to 1 Amp while the instantanious trip delay can be set from 100 ms up to 1 second. Harmonic filtering to the 24th octave renders high stability when starting motors D.O.L and when used in conjunction with VSDs*
- *ANOTHER dedicated output relay will energise just as soon as the earth leakage current detected is re-classified as an EARTH FAULT when the current exceeds 1 Amp*
- *This built-in trip co-ordination assures that the main contactor is not used to clear a potentially damaging high energy fault current*
- *The trip delay in the case of earth fault is 100 ms. In the case of an earth fault the main trip contact is energised 1 second after the dedicated "back tripping" contact.*



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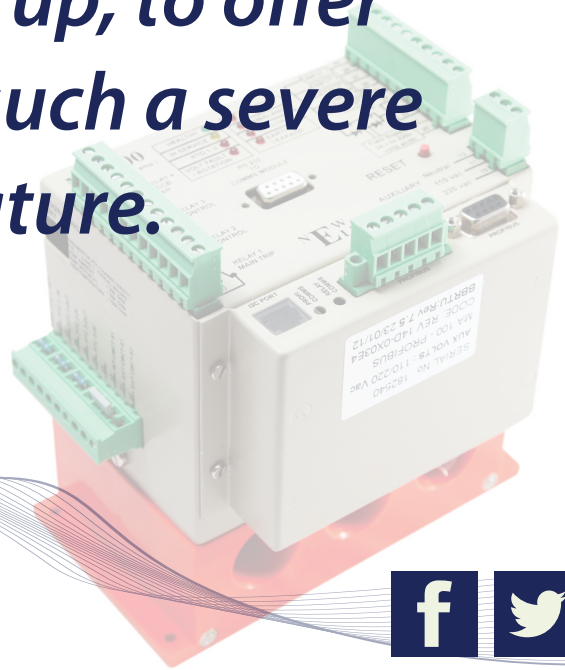
Short Circuit Faults

Such faults, can sometimes happen. While a back up circuit breaker will often be used to break such faults added assurance can be obtained by using a motor protection relay capable, as a back up, to offer additional protection when encountering such a severe fault usually of a phase to phase nature.



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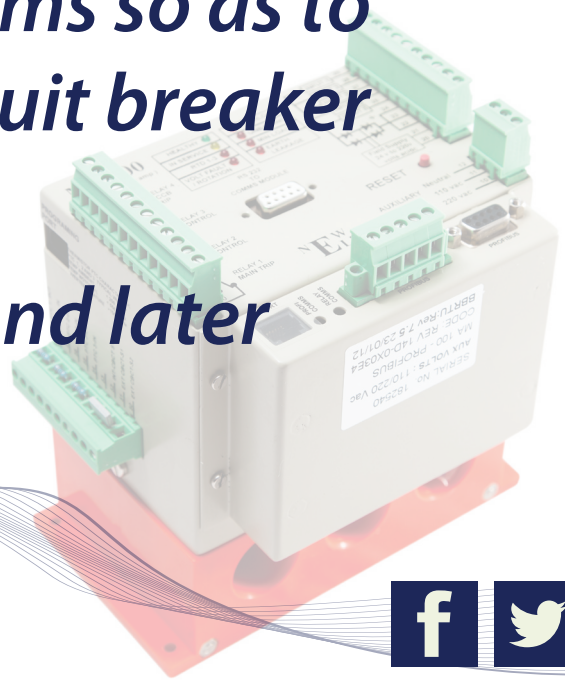
How Can We Aid In The Identification And Clearance Of A Short Circuit Fault?

- Our protection relay will identify a short circuit fault current at 10 times motor full load setting
- On detection of such a fault current the "dedicated back up" trip contact will energise in 100 ms so as to clear the fault through the up stream circuit breaker by means of a shunt mechanism
- The main trip contact will energise 1 second later



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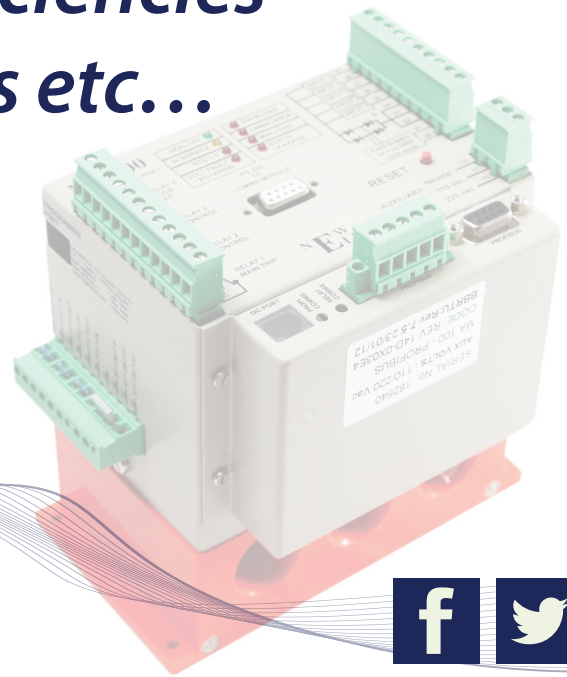
Underload Related Problems

- *Many applications (particularly those related to pumps) require the monitoring of load loss. Alternatively…..*
- *Assistance in the detection of drop in efficiencies*
- *Detecting broken belts, chains, couplings etc…*



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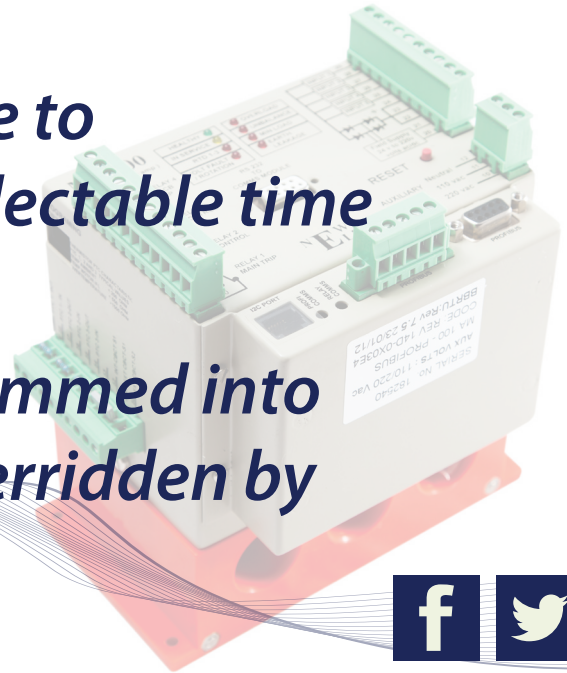
How Can The Motor Protection Relay Be used To Our Advantage To Monitor Decreases In Load?

- *The NewElec motor protection relay will permit the user to set an underload detection threshold in the range 20 to 100 % of maximum load setting with a user-selectable trip delay ranging from 1 to 10 seconds*
- *In addition, and if desired, the user could decide to automatically restart his motor after a user- selectable time delay. Sump pump applications*
- *The facility for doing this is already pre- programmed into the relay for convenience, although may be overridden by the user*



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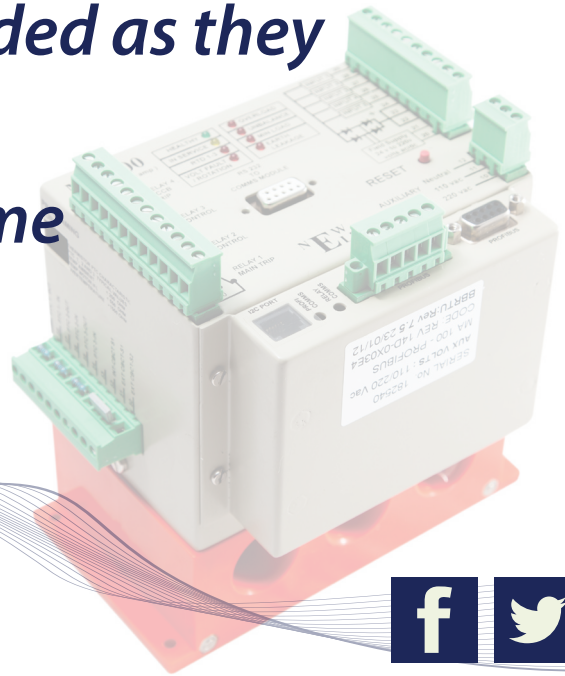
Over / Under Voltage & Phase Rotation Related Faults

- *Motors operating under their specified voltage will draw more current and their output torque will drop exponentially to the drop in voltage*
- *Overvoltage conditions are likewise to be avoided as they induce over fluxing and additional heat*
- *Correct phase rotation can be important in some applications!*



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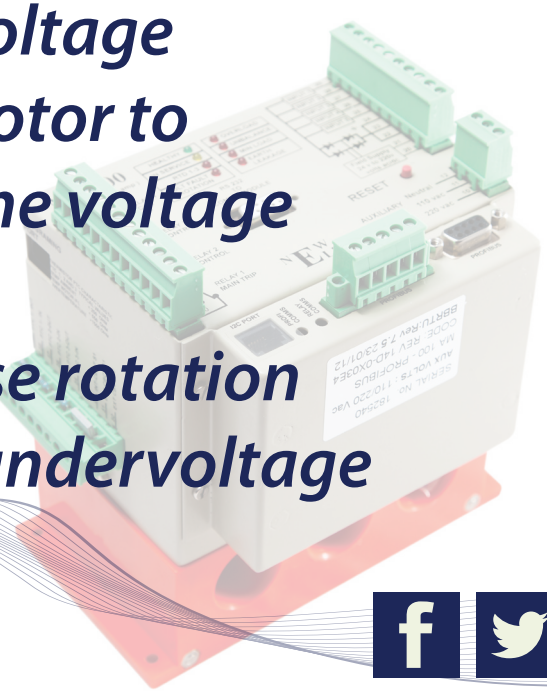
How do we prevent the motor from running when exposed to over or undervoltage conditions?

- NewElec is sensitive to the requirement of production
- The voltage supplied to the motor is first checked for proper phase rotation
- The protection relay then measures the input voltage for reference purposes and then waits for the motor to complete its start sequence before continuing the voltage measurement
- A trip is initiated immediately on incorrect phase rotation
- A trip is initiated after 15 seconds if an over or undervoltage condition should



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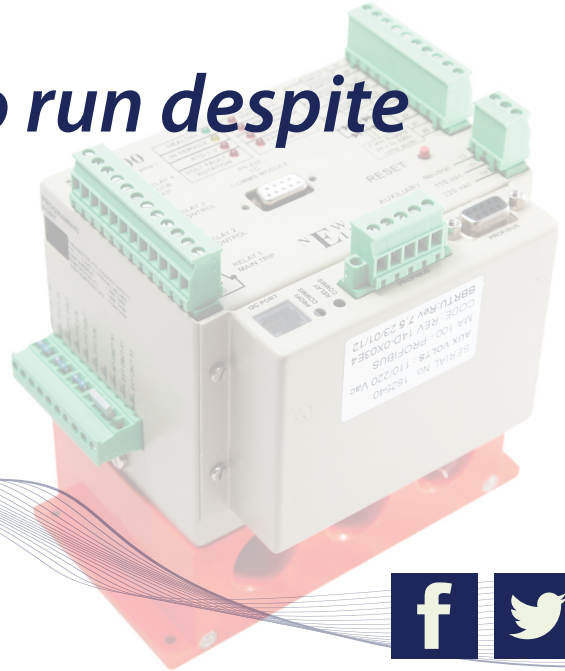
Main Contactor Fails To Open!

It may sometimes happen that, due to arcing, corrosion or lack of maintenance, the main holding contactor fails to open when the supply to the coil is removed

In such a case the motor would continue to run despite the STOP initiation command.



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How do we prevent this from happening?

The protection relay must recognise that the motor has continued running despite having been commanded to STOP by the relay!

The new relay under discussion when encountering such a situation will automatically energise one of its pre-programmed output contacts to trip through the back-up circuit breaker by means of a shunt 1 second after detecting a FROZEN contactor condition

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General Over Temperature Related Problems

All of the protection features and benefits discussed thus far rely on current and voltage measurements.

Motor manufacturers remind us that thermistors go a long way in providing protection against all of the above (except load loss). In addition they will provide protection against blocked ventilations and high ambient temperatures as well.

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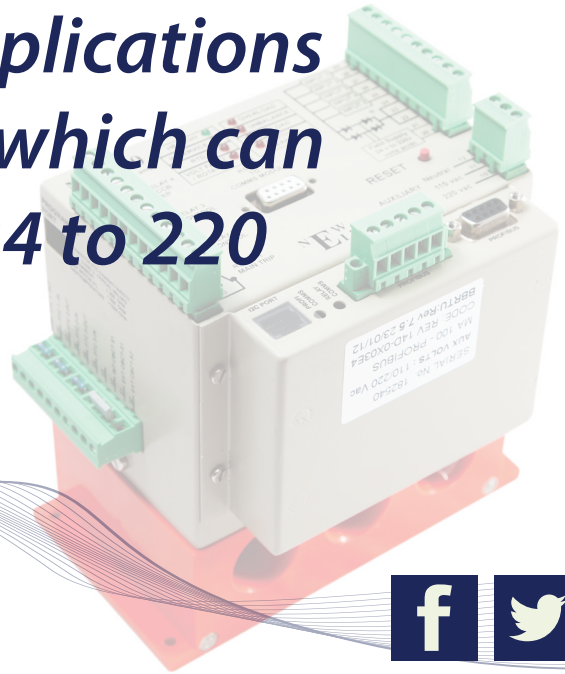
Stand Alone Relay Facilities

- *The relay has 4 output contacts, 10 Amp rated at 220 Volt a.c.*
- *All are allocated functions on leaving the factory*
- *Two may be re-programmed to suit site applications*
- *The relay is equipped with 5 digital inputs which can accommodate a field supply in the range 24 to 220 Volt a.c/ d.c.*



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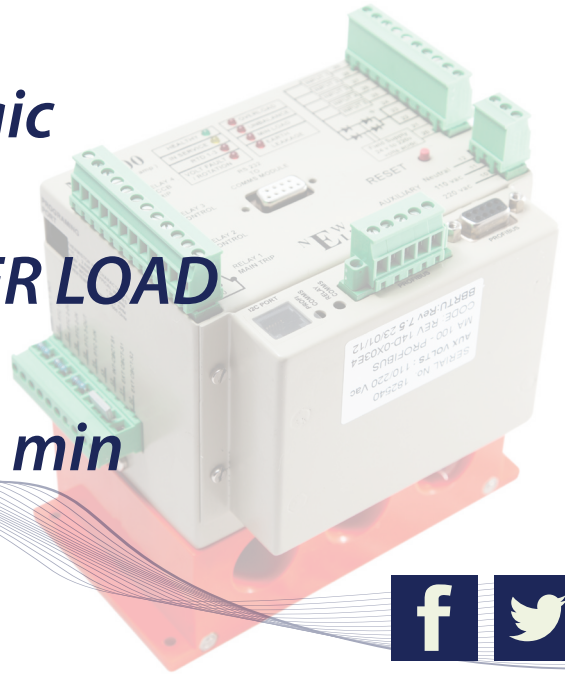
Innovative solutions from South Africa's Leading Motor Protection Specialists

NewElec MA Motor Protection Control in standalone mode

- *Parameterisation via MA front end software or RDU 216 remote display unit*
- *Control of Relay 2 and Relay 3*
- *4 input truth table utilising*
- *Digital inputs (1),(2),(3) and (4)*
- *"IN" service OR "OUT" service programmable logic*
- *ALARM output on:*
- *OVERLOAD,UNBALANCE,THERMISTOR and UNDER LOAD selectable logic*
- *Time delayed output selectable from 0,1sec to 50 min*
- *Digital input 5 assigned as remote reset*



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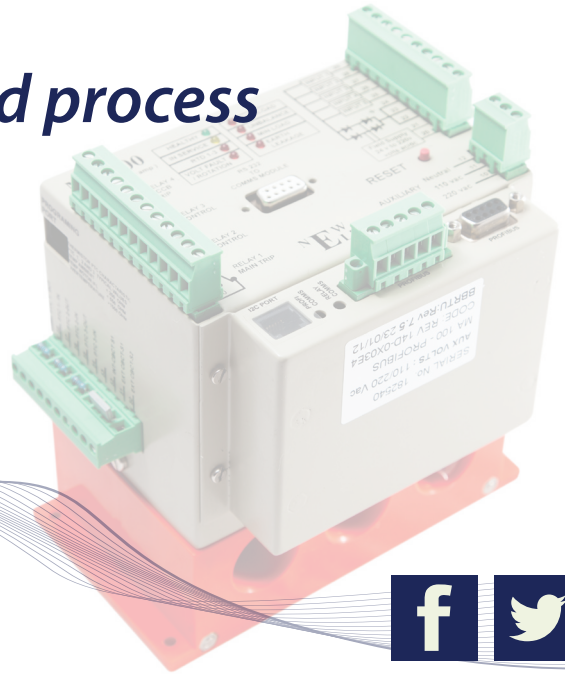
NewElec MA Motor Protection Control in STANDALONE mode
Additional features of RDU 216:

- Stores 8 preset relay and I/O map settings
- Download Presets Dongel protected
- Editing of Presets Dongel protected
- Operator Read only access to all fault records and process data
- Gate end box relay settings changed by loading
- Preset under Dongel control



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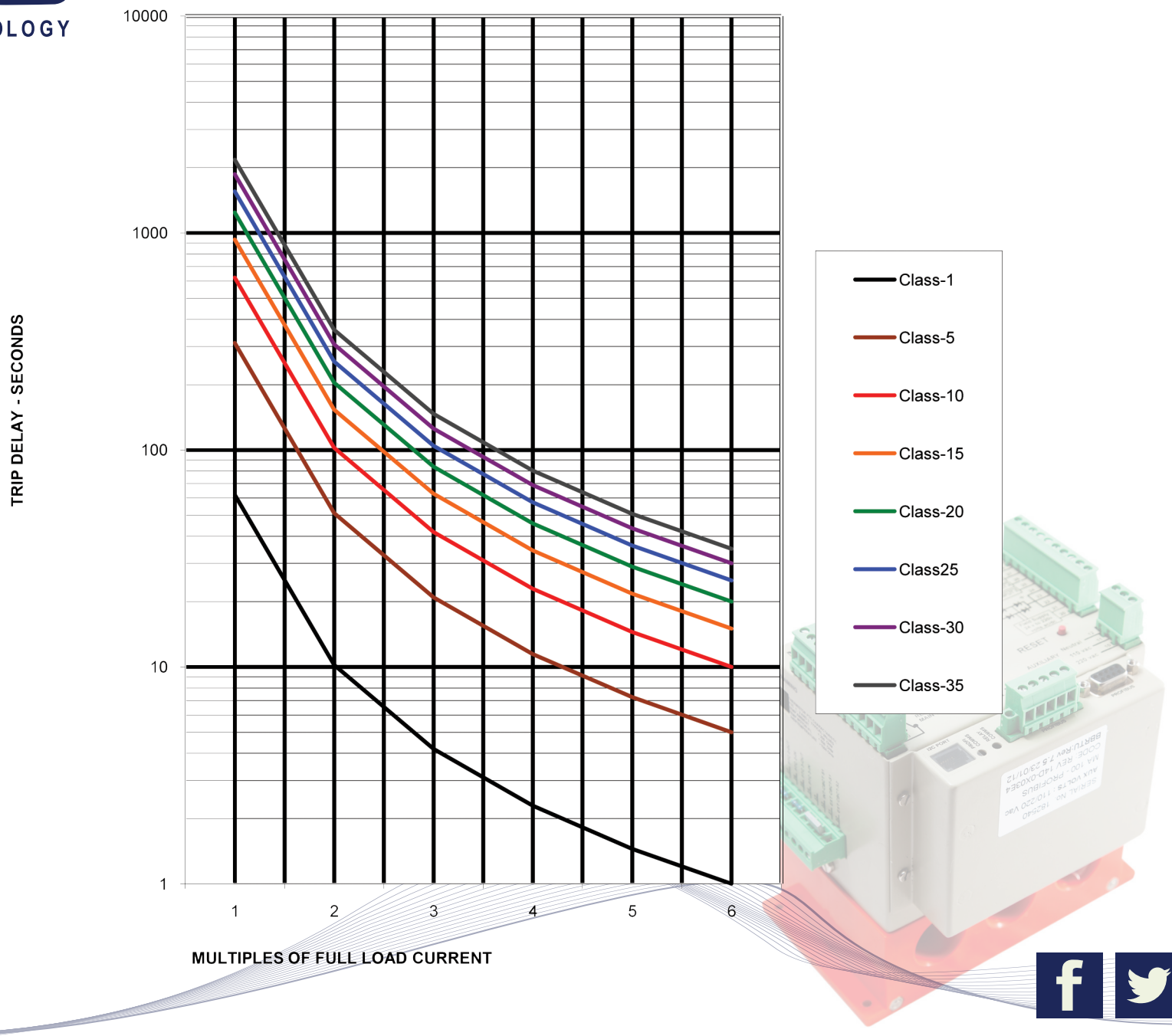

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Newelec MA Relay preloading 15 Sec Cold – 5 Sec Hot curve

5 Jun 03	I - Red %	I - White %	I - Blue %	Th Cap %	V phase	V Line
13:23:05	96	96	96	10	313	547
13:24:00	96	96	96	12	313	547
13:25:00	96	96	96	13	313	547
13:26:00	96	96	96	15	313	547
13:27:00	96	96	96	16	313	547
13:28:00	96	96	96	18	316	552
13:29:00	96	96	96	19	316	552
13:30:00	96	96	96	21	313	547
13:31:00	96	96	96	23	313	547
13:33:00	96	96	96	26	316	552
13:34:00	96	96	96	27	313	547
13:35:00	96	96	96	29	313	547
13:36:00	96	96	96	31	313	547
13:37:00	96	96	96	32	316	552
13:38:00	96	96	96	34	313	547
13:39:00	96	96	96	35	313	547
13:40:00	98	98	98	37	309	541
13:41:00	96	96	96	38	313	547
13:42:00	96	96	96	40	313	547

5 Jun 03	I - Red %	I - White %	I - Blue %	Th Cap %	V phase	V Line
13:43:00	96	96	96	42	313	547
13:44:00	96	96	96	43	313	547
13:45:00	96	96	96	45	313	547
13:46:00	96	96	96	46	313	547
13:47:00	96	96	96	48	316	552
13:48:00	96	96	96	49	313	552
13:49:00	96	96	96	51	316	552
13:50:00	96	96	96	53	313	547
13:51:00	96	96	96	54	313	547
13:52:00	96	96	96	56	313	552
13:53:00	96	96	96	57	313	547
13:54:00	96	96	96	59	313	547
13:55:00	96	96	96	61	316	552
13:56:00	96	96	96	62	316	552
13:57:00	96	96	96	64	313	547
13:58:00	96	96	96	65	313	547
13:59:00	96	96	96	67	313	547
14:00:00	96	96	96	68	313	547
14:01:00	96	96	96	70	313	547

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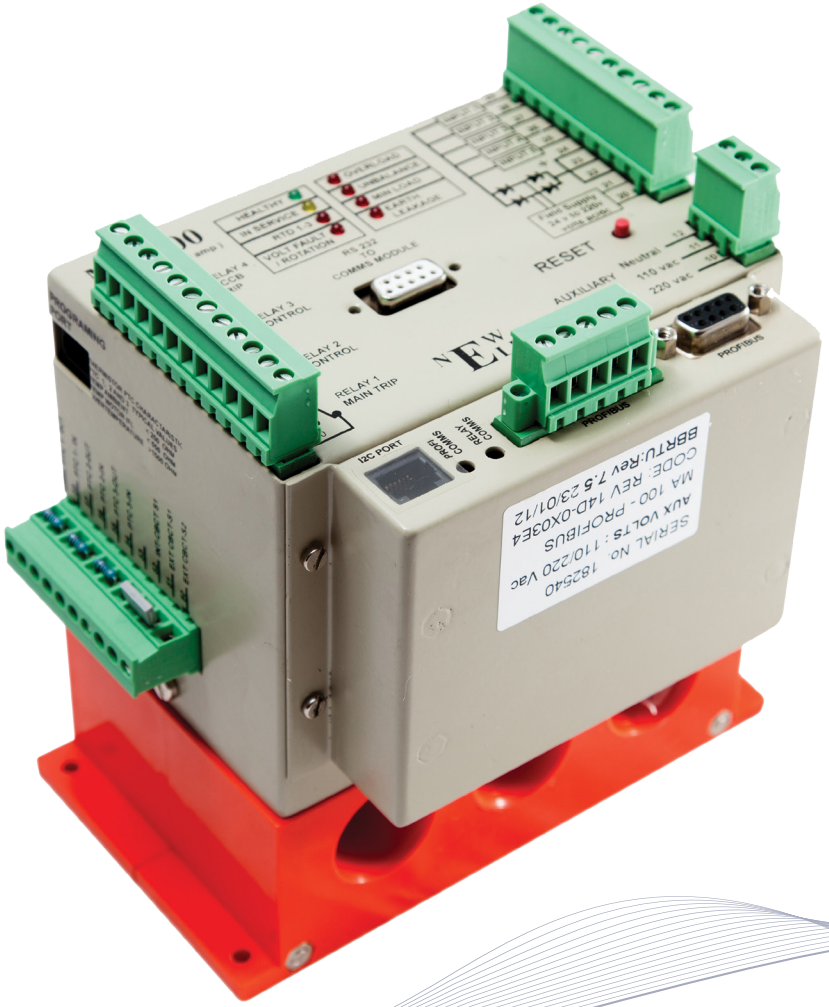
PLC Control Aspects of the MA Relay



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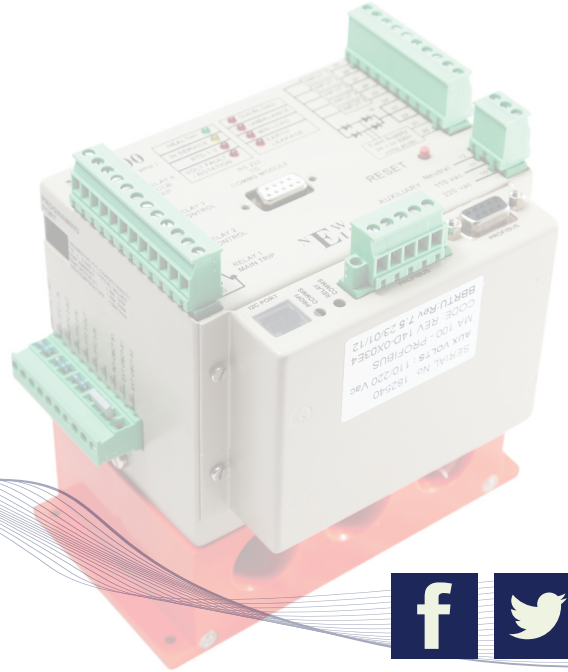
Profibus MA Motor Protection & Control

- *Multi-drop 2 wire I/O control utilising Profibus DP*
- *5 digital inputs powered 24V to 220V ac/dc*
- *4 relay outputs 220V a.c 10 amp*



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Cyclic Data Out (from PLC)

Byte, bit	Parameter	Meaning	Cyclic Output
Byte 0.0	RelayControl_C,0	Relay_1	Not Controlled
Byte 0.1	RelayControl_C,1	Relay_2	Relay_2
Byte 0.2	RelayControl_C,2	Relay_3	Relay_3
Byte 0.3	RelayControl_C,3	Relay_4	Not Controlled
Byte 0.4	RelayControl_C,4	MA configuration00H to 06H Stand Alone Relay 07H-08H PLC control & Data	MA configure.0 (LSB)
Byte 0.5	RelayControl_C,5		MA configure.1
Byte 0.6	RelayControl_C,6		MA configure.2 (MSB)
Byte 0.7	RelayControl_C,7	Set to maintain Relay Output Status if PLC communications fail.	Operation Control Status
Byte 1.0	RelayControl_D,0		
Byte 1.1	RelayControl_D,1		
Byte 1.2	RelayControl_D,2		
Byte 1.3	RelayControl_D,3		
Byte 1.4	RelayControl_D,4		
Byte 1.5	RelayControl_D,5		
Byte 1.6	RelayControl_D,6	Set To Reset Relay Fault condition	Reset Relay
Byte 1.7	RelayControl_D,7	Set to enable MArelay settings down loaded from PLC	Parameterize Relay

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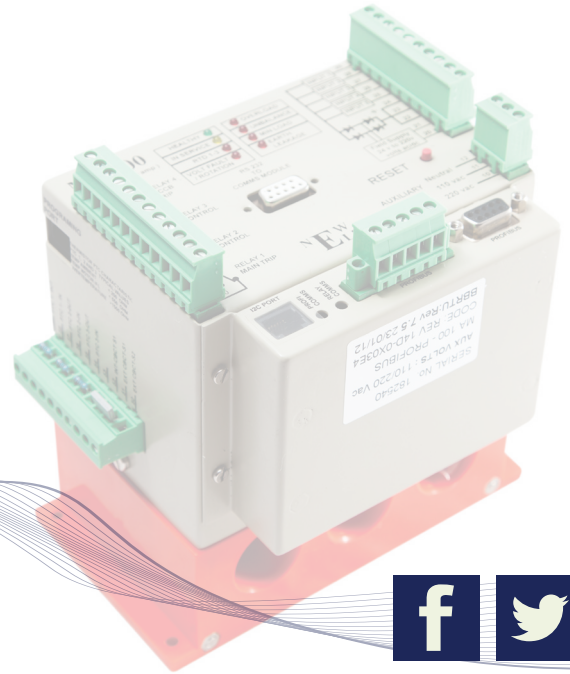
NewElec MA Profibus Data Cyclic Data – IN to PLC

- *Status of 5 digital inputs on MA relay*
- *Communications status MA relay healthy*
- *Actual load current being drawn by motor*
- *Motor reserve thermal capacity (0 – 100)%*
- *Accumulated totalled running hours of motor*
- *Motor IN SERVICE indication*



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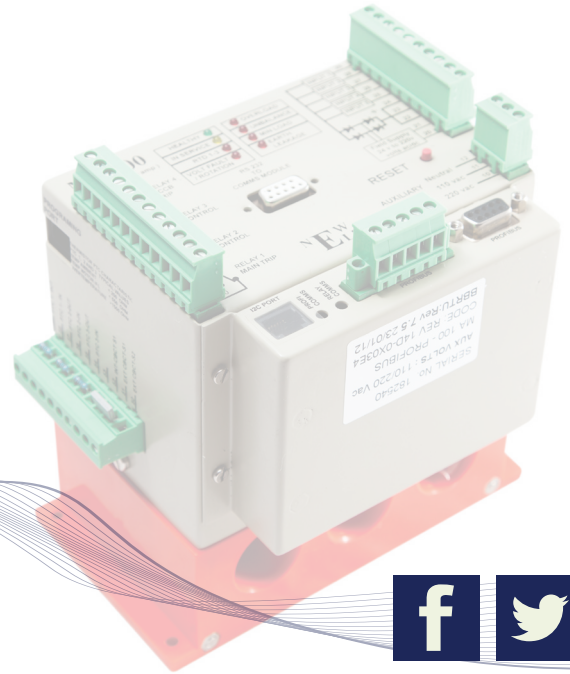
NewElec MA Profibus Data
Cyclic Data – IN to PLC

- *Alarm and trip flags for protection features*
- *Overload*
- *Unbalance*
- *Minimum load*
- *Earth leakage*
- *Overvoltage*
- *Undervoltage*
- *Phase rotation*
- *Frozen contactor*



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Cyclic Data Out (from PLC)

Byte, bit	Parameter	Meaning	Cyclic Output
Byte 0.0	RelayControl_D,0	Set = Input 1 open	Digital_Input_1
Byte 0.1	RelayControl_D,1	Set = Input 2 open	Digital_Input_2
Byte 0.2	RelayControl_D,2	Set = Input 3 open	Digital_Input_3
Byte 0.3	RelayControl_D,3	Set = Input 4 open	Digital_Input_4
Byte 0.4	RelayControl_D,4	Set = Input 5 open	Digital_Input_5
Byte 0.5	RelayControl_D,5		
Byte 0.6	RelayControl_D,6		
Byte 0.7	RelayControl_D,7	MA-CommFailure	MA-CommFailure
Byte 1.0	Alarm_Flag_A,0	Motor Running	InServiceFlag
Byte 1.1	Alarm_Flag_A,1	Overcurrent Alarm	OC_Flag
Byte 1.2	Alarm_Flag_A,2	Unbalance Alarm	UnbalFlag
Byte 1.3	Alarm_Flag_A,3	Min Load Alarm	UC_Flag
Byte 1.4	Alarm_Flag_A,4	Earth Leakage	EL_Flag
Byte 1.5	Alarm_Flag_A,5	Under Voltage	Volt_Flag
Byte 1.6	Alarm_Flag_A,6	Over temperature	RTD Flag
Byte 1.7	Alarm_Flag_A,7	Frozen Contactor	FrozenCnt_Flag
Byte 2.0 - 2.7	ActualLoadCurrent	Actual Load Current	
Byte 3.0	TripFlag_A,0	Overcurrent Trip	OC_TripFlag
Byte 3.1	TripFlag_A,1	Unbalance Trip	UnbalTripFlag
Byte 3.2	TripFlag_A,2	Single Phase Trip	SP_TripFlag
Byte 3.3	TripFlag_A,3	Min Load Trip	UC_TripFlag
Byte 3.4	TripFlag_A,4	Earth Leakage Trip	EL_TripFalg
Byte 3.5	TripFlag_A,5	Phase Rotation Trip	VoltTrip_Flag
Byte 3.6	TripFlag_A,6	Overtemperature Trip	RTD_TripFlag
Byte 3.7	TripFlag_A,7	Frozen Contactor Trip	FrozenCnt_TripF
Byte 4.0 – 4.7	ThermalCap	Thermal Capacity	
Byte 5.0 – 5.7	RunHourLo	Running Hours	
Byte 6.0 – 6.7	RunHourHi		

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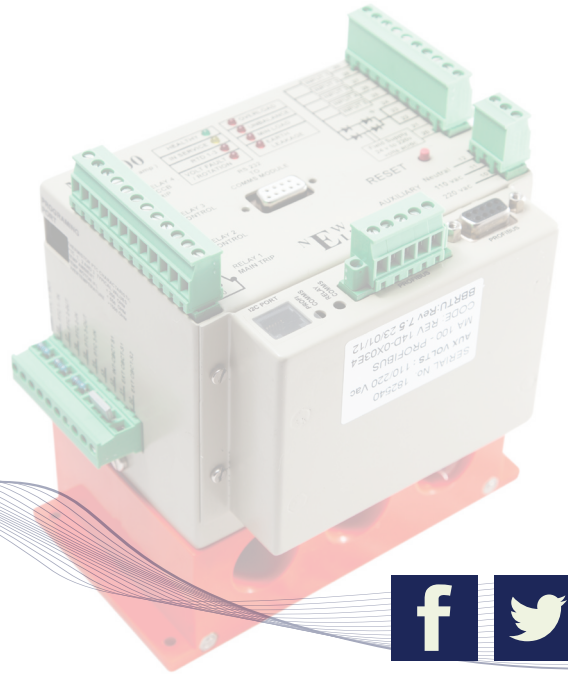
NewElec MA Profibus Diagnostic Data – IN to PLC

- *Thermal capacity remaining as % of total*
- *Totalled running hours*
- *Trip fault counter*
- *Totalled number of start-up operations*
- *Last 4 faults RTC time and date stamp*
- *Last power-up RTC time and date stamp*



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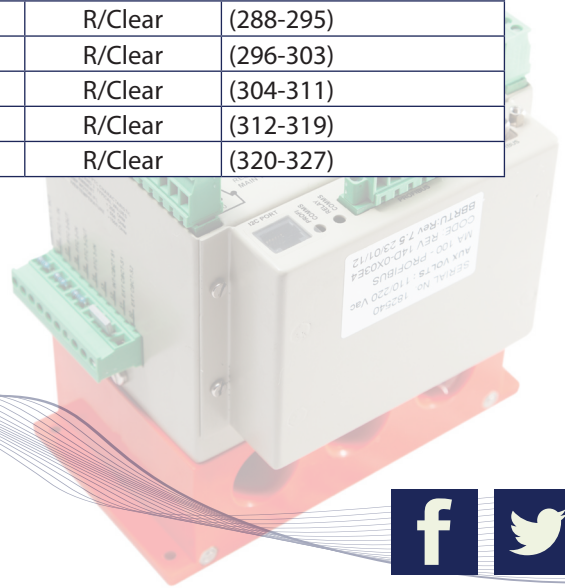
Diagnostic Data			
Parameter	**Meaning**	**Access**	**Bit range**
UserDiagLen	Length diagnostic telegram	DP	0 -7
Thermal Cap	Thermal Capacity	R/W	(8 - 15)
RunHourCntr	Totaled Running Hours	R/Clear	(16-23) (24-31)
TripFaultCnt	Trip Fault Counter	R/Clear	(32-39) (40-47)
StartUpCntr	Totaled Number of Starts	R/Clear	(48-55) (56-63)
LastFault1	Most recent fault	R/Clear	(64-71) (72-79)
LF1 Year	Time Stamp Year	R/Clear	(80-87)
LF1 Month	Time Stamp Month	R/Clear	(88-95)
LF1 Day	Time Stamp Day	R/Clear	(96-103)
LF1 Hour	Time Stamp Hour	R/Clear	(104-111)
LF1 Min	Time Stamp Minute	R/Clear	(112-119)
LastFault2	Previous Fault	R/Clear	(120-127) (128-135)
LF2 Year	Time Stamp Year	R/Clear	(136-143)
LF2 Month	Time Stamp Month	R/Clear	(144-151)
LF2 Day	Time Stamp Day	R/Clear	(152-159)
LF2 Hour	Time Stamp Hour	R/Clear	(160-167)
LF2 Min	Time Stamp Minute	R/Clear	(168-175)
LastFault3	Post Previous Fault	R/Clear	(176-183) (184-191)

Diagnostic Data			
Parameter	**Meaning**	**Access**	**Bit range**
LF3 Year	Time Stamp Year	R/Clear	(192-199)
LF3 Month	Time Stamp Month	R/Clear	(200-207)
LF3 Day	Time Stamp Day	R/Clear	(208-215)
LF3 Hour	Time Stamp Hour	R/Clear	(216-223)
LF3 Min	Time Stamp Minute	R/Clear	(224-231)
LastFault4	Post, Post Previous Fault	R/Clear	(232-239) (240-247)
LF4 Year	Time Stamp Year	R/Clear	(248-255)
LF4 Month	Time Stamp Month	R/Clear	(256-263)
LF4 Day	Time Stamp Day	R/Clear	(264-271)
LF4 Hour	Time Stamp Hour	R/Clear	(272-279)
LF4 Min	Time Stamp Minute	R/Clear	(280-287)
StrtUpYear	Year	R/Clear	(288-295)
StrtUpMnth	Month	R/Clear	(296-303)
StrtUpDay	Day	R/Clear	(304-311)
StrtUpHour	Hour	R/Clear	(312-319)
StrtUpMin	Minute	R/Clear	(320-327)



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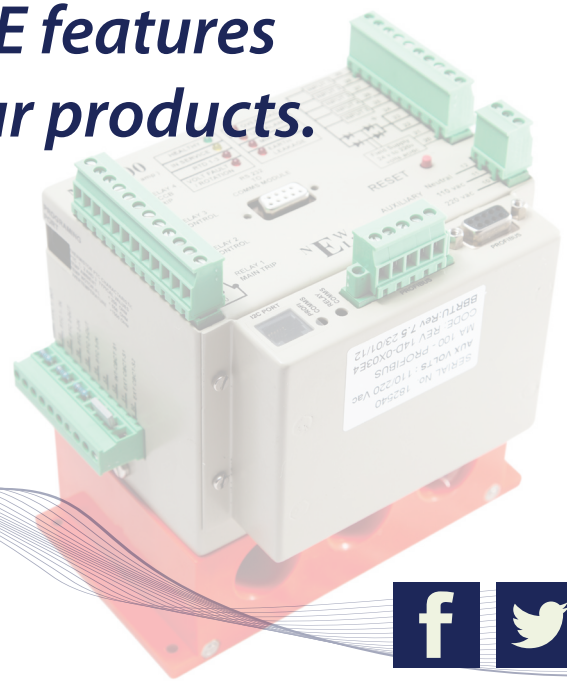
This Brings Us to The End of This Overview on the Latest Motor Protection Product From NewElec

- *We wish to end off by listing some additional FREE features and benefits your company can enjoy by using our products.*



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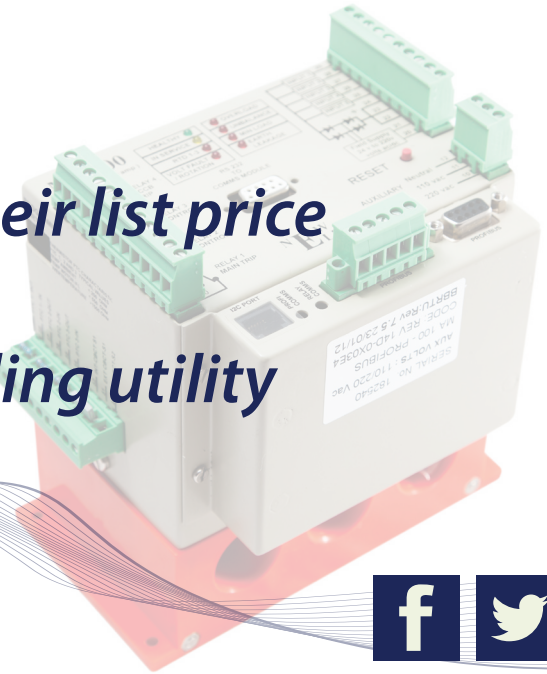
Pertaining To This Product

- *Front end software is FREE!*
- *Necessary electronic files for PLC provided free*
- *The software includes a utility for storing and retrieving all relay settings in your plant*
- *This is useful for multi-downloading*
- *We provide a 3 year renewable guarantee*
- *We repair products out of guarantee for 30% of their list price and renew the guarantee*
- *The front end software comes with a useful recording utility*



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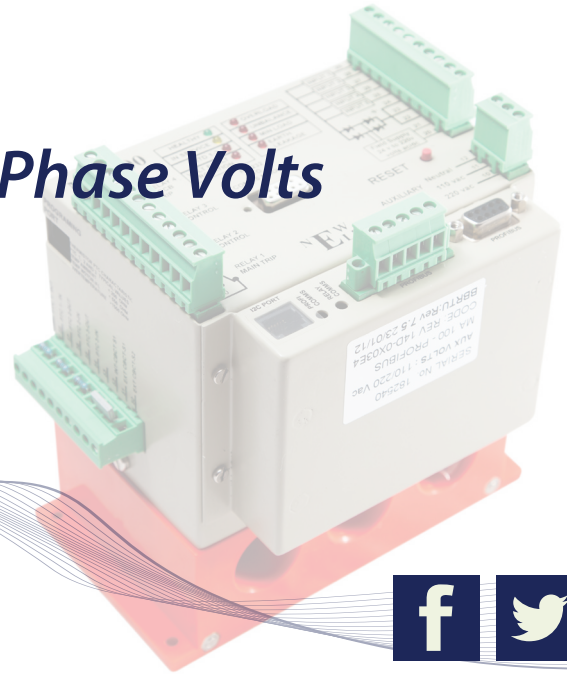
What YOU can record while your motor is running

- *Current, voltage and thermal capacity recording on 1 sec interval with RTC*
- *Export text file to Excel for calculation and data manipulation or report generation*
- *Values recorded*
- *I red, I white, I blue, Thermal Capacity, Line Volts, Phase Volts*
- *24 hour recording approx 7 Megabyte Excel file*



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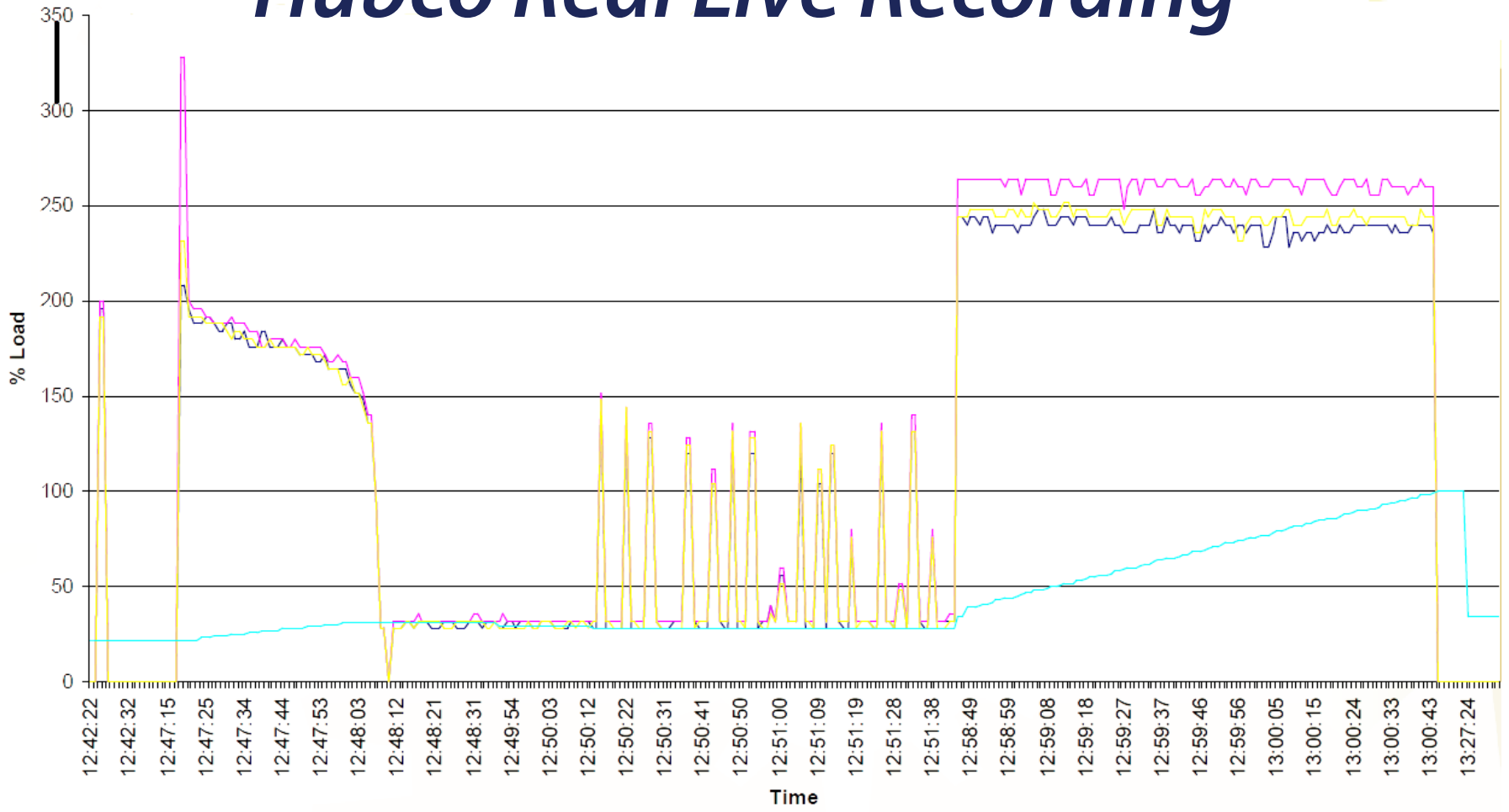
Hubco Real Live Recording



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Advantages to end user

- *Easy automation of existing plant equipment. Use existing control voltage!*
- *Responsible fault trip co-ordination*
- *Multiple protocol choices. Profibus DP, Modbus,*
- *Canbus or DeviceNet already available*
- *Mod Ether software & complete hardware compatibility 1st ¼ 2006*
- *LOCAL SUPPORT!*

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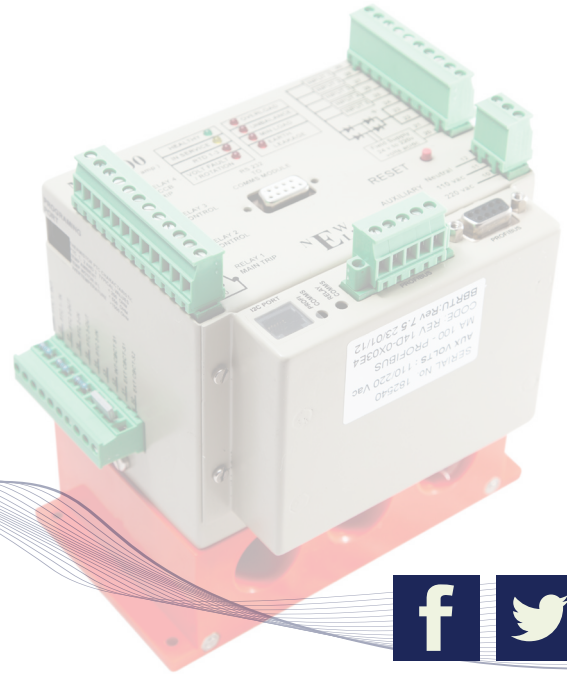
Where Have We Successfully Automated Plants?

- *Iscor Elisras (Kumba Resources)*
- *Columbus Stainless Steel*
- *South Witbank Colliery*
- *Iscor Van Der Bijlpark (now Mittal Steel)*
- *Portnet Saldanha*
- *Douglas Colliery*
- *Umgeni Water*



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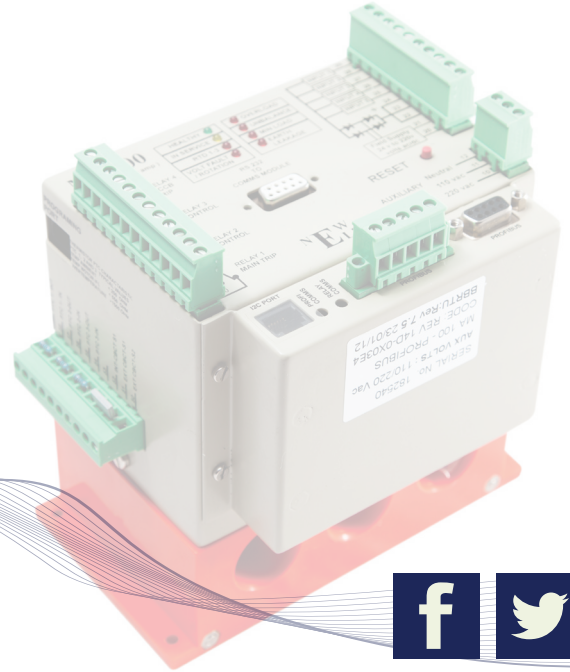
We provide a 1 year renewable guarantee

We repair products out of guarantee for 50% of their list price and renew the guarantee

Local support



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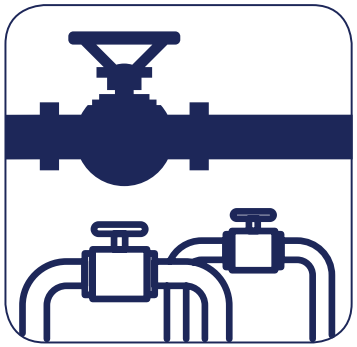
Applications particularly well suited for use in conjunction with the NewElec range of electronic motor protection relays.

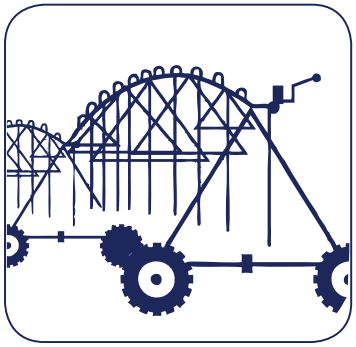
Mining



Water Affairs

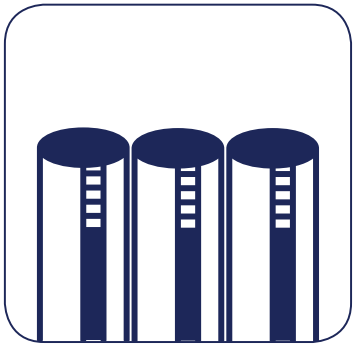
Petro Chemical

Refineries



Agriculture

Material Handling



Mills

Cable Theft Detection

Pulp & Paper

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