PM-DMCM
Digital Condition Monitor/True RMS Multimeter

1. INTRODUCTION

Company production requirements of today are being fulfilled by the use of existing machineries and equipments while on the other side an intensive effort to reduce production and operation costs is vitally necessary. Some of the most common and cost effective expenditures are those being resulted with the consequences of “unplanned organizations and operations” and there of the maintenances. Only way to minimize such costs and expenses or to prevent them happening is mainly based on detecting mechanical and electrical failures at their very early stages.

PM-DMCM is a micro-process controller monitoring and measuring frequency of line, current and voltage values of three phase systems.
State of the art micro-processing technology built in Digital Condition Monitor/True RMS Multimeter is designed to sense, detect and inform impending mechanical and electrical failures in 3 phase motors and motor run – operating systems at the early stages of fault occurrence while its panel multimeter function enables 3 phase current readings, phase to phase voltage and frequency readings.

3 phase currents and voltages are the only measurements used by the technology within the framework of “Model Based Fault Detection Logic”. Thanking to power of Digital Condition Monitor/True RMS Multimeter Technology with the capability of fault detection at early stage which provides an excellently reliable system monitoring advantages , a remarkable productivity of quality production, minimized maintenance and repair costs and extended life of machinery and equipment in use. Here are some of the electrical and mechanical breakdowns / faults that PM-DMCM can determine / detect:

a- Ball Bearing Problems
b- Misalignment Errors
c- Unbalanced Load
d- Rotor and Stator faults
e- Unbalanced Power
f- Pump, Compressor, Gear Box, Fan Problems

PM-DMCM has features of adjustable over/under current and voltage protection limits with adjustable time delay settings prior to producing contact output for alert

2. OPERATIONAL SET UP AND ADJUSTMENTS

Connection must be performed due to wiring diagram (pls. see figure 1). After having the connection of and energizing the device completed, PM-DMCM learning process onto some certain characteristics/data of the system in where used is proceeded. For this reason, once the device energized, the measured values are displayed via on LEDs while on the other side, the required datas and informations about the system are received. PM-DMCM determines the status of learning by checking whether the received and then the saved data on system would be enough or not before proceeding into a very next step at each time of energizing. User can monitor the status of device through the 7^{th} menu (pls. see 8). A current reading should be displayed first once the device energized. The CT ratio and the required settings should be correctly entered in order to obtain a reliable reading.
L1, L2, L3 indicate 3 phase connection; N corresponds to neutral. Outer terminals of the main CT should be connected into $I1_1$-$I1_2$, $I2_1$-$I2_2$ and $I3_1$-$I3_2$.

2.1. SETTING CURRENT TRANSFORMER RATIO

Press “<>” button, “CTR” and “SET” will be displayed on the lower side of display consequently. Press “<>” button again. The lowest display will show current CTR value (default is 5) Pressing “UP” or “DOWN” buttons enable user to adjust the desired CTR value. Once “<>” button is pressed again the adjusted value will be saved in non-volatile memory.
Press “UP” button until “ESC” appears on the lowest display. Press “<>” button again. After a short time device will return to its normal operation mode.

2.2. SETTING OVER VOLTAGE PROTECTION LEVEL

Press “<>” button. Press “UP” button until “UuL” “SET” appears on display. Pressing “<>” button again will indicate “Over Voltage Limit” on the lowest display Adjust the desired value and press “<>” button to save. Press “UP” button until “ESC” appears on lowest display. Press “<>” button to Escape. After a short time device will return to its normal operation mode.

2.3. SETTING UNDER VOLTAGE PROTECTION LEVEL

Press “<>” button. Press “UP” button until “Udl” “SET” appears on display. Pressing “<>” button again will indicate “Under Voltage Limit” on the lowest display. Adjust the desired value and press “<>” button to save. Press “UP” button until “ESC” appears on lowest display. Press “<>” button to Escape. After a short time device will return to its normal operation mode.

2.4. SETTING OVER CURRENT PROTECTION LEVEL

Press “<>” button. Press “UP” button until “IuL” “SET” appears on display. Press “<>” button again the lowest display will show “Over Current Limit” Adjust the desired value and then press “<>” button to save. Press “UP” button until “ESC” appears on lowest display. Press “<>” button to Escape. After a short time device will return to its normal operation mode.

2.5. SETTING UNDER CURRENT PROTECTION LEVEL

Press “<>” button. Keep pressed until “IdL” “SET” texts are displayed. Under Current Protection values can be seen on the bottom LED once “<>” pressed. Set the protection value of request and save it by pressing “<>”. Press “UP” button until “ESC” appears on lowest display. Press “<>” button to Escape.

2.6. SETTING TIME DELAY

Press “<>” button. Press “UP” button until “dEt” “SET” appears on display. By pressing “<>” button again the lowest display will show the delay time of contact output for both current and voltage. Adjust the desired value and press “<>” button again. Adjusted value will be stored into memory. Press “UP” button until “ESC” appears on lowest display. Press “<>” button to escape. After a short time device will return to its normal operation mode. Delay time will be activated prior to switching the relay on but in time of current/voltage failure occurrence.

2.7. RESET / UPDATE OPERATION MODE

Press “<>” button. Keep “UP” button pressed until “rSP” ,“UPP” and “SET” texts are displayed. After having “<>” button pressed again , “k” LED on the left corner of “RESET” command is turned on by indicating that the device is in “RESET” mode. With the use of “UP” button, reset operation can be performed within active “rSA” or passive “rSP” position. Hence, the device can be reseted. Pressing “<>” button one more time “RESET” can be activated or passivated while the LED “k” is turned on at a

second time of which shall indicate that the device is in update mode. With the use of update button, update operation can be performed within active “uPA” or passive “uPP” position. Hence the device can be updated respectively. Make sure that the device should be at “St4” position in order to activate an update operation. Once the activated commands are processed, all will shift into passive position accordingly. After the completion of the required adjustments, hold “UP” button pressed until the “ESC” text is displayed on the lower LED. Pressing “<>” should revert the program back to the menu on where the last measurement executed.

Reset command; shall be used for a radical or substantial change on the operating system of the network. Using “RESET” mode will clear / delete all the formerly saved informations and then, will shift into learning mode in such a way to start learning and saving from the very beginning (from “st1” to “st4”).

urS : it shows software version of the devices.

Update Command; is a short time based learning mode and shall be used for to let the system or network changes be introduced into the device. Once “UPDATE” command activated, data changes pertained on the system shall be sensed and gathered at “st5” mode and then the device will revert back to “st4” mode to proceed the operation.

St1: Check Mode **:** Device checks if the system is suitable for detective application or not.

St2: Learning Mode **:** Device collects data from the system which is necessary for establishing the model.

St3: Improve Mode **:** Device is improving the data and calculating model parameters.

St4: Monitoring Mode: After creation of model device compares actual system and established model (Normal Operation).

St5: Update Mode **:** Device updates system model by collecting changed system data. This period is shorter then Learning mode.

2.8. PROGRAMING RELAY OUTPUT

Press “<>” button. Keep “UP” button pressed until “rLy” on the top display and “SET” on the bottom display are displayed. After having “<>” button pressed again, “k” LED on the left corner of top display is turned on by indicating that the device is in relay output programming mode. By using UP and DOWN button, relay output can be assigned desired options explained below. These options can be activated or deactivated separately.

When “Cur” text is displayed on the middle display, push the “<>” button. “PAS” or “Act” text will be shown on the middle display. If “PAS” option is selected, relay output will never be affected from any condition which is related with currents. If “Act” option is selected, the relay output will be affected from failure condition which is related with currents. After selecting necessary option, user must push “<>” button to accept changes. This option is related with only current failure condition. If one of the over current protection or under current protection failures or both of them are occurred, relay will be energized and relay will change contact position.

When “Uol” text is displayed on the middle display, push the “<>” button. “PAS” or “Act” text will be shown on the middle display. If “PAS” option is selected, relay output will never be affected from any condition which is related with voltages. If “Act” option is selected, the relay output will be affected from failure condition which is related with voltages. After selecting necessary option, user must push “<>” button to accept changes. This option is related with only voltage failure condition. If one of the over voltage protection or under voltage protection failures or both of them are occurred, relay will be energized and relay will change contact position.

“dEd” Relay output will be activated for system warnings of Digital Condition Monitor/True RMS Multimeter. If this option is chosen by SET button, User must select which warning of Digital Condition Monitor/True RMS Multimeter will activate relay output. After selecting necessary warning option, “PAS” or “Act” text will be shown on the middle display for the selected option. “PAS” means that relay output will never be activated for any condition which is related with selected option. “Act” option means that the relay output will be affected any condition which is related with selected option. These warnings are explained below.

“Lod” If the system has overload or WATCH LOAD warning, the devices will activate relay output.

“Lin” If the system has an electrical failure or WATCH LINE warning, the devices will activate relay output.

“En1” If the system has a failure beginning or device gives PERFORM MAINTENANCE warning, the devices will activate relay output.

“En2” If the system has a improved failure or device gives STOP warning, the devices will activate relay output.

After the completion of the required adjustments, press “UP” or “DOWN” button until the “ESC” text is displayed on the middle display. Pressing “<>” button, device will turn back to main setting menu, press “UP” or “DOWN” button until the “ESC” text is displayed on the lowest display. Press “<>” button, device will turn back to main program menu on where the last measurement executed.

3. DISPLAY OF CURRENT READING

Current values of 3 phase are displayed simultaneously with an amp rating up to 10000 A. If current readings of phases exceed 1000A a point after number is companied as of “x1000” of which shall be symbolized by the Led “k” is on. A direct connection of up to 5A can be performed while a CT shall be needed above 5 Amp. “I(A) on the front top indicates this reading.

4. PHASE – NEUTRAL VOLTAGE READING

Pressing “UP” button in time of displaying current reading, phase–neutral voltage readings of phases are displayed simultaneously within the range of 0 -300 V “V L-N (V)” indicates this reading.

5. PHASE –PHASE VOLTAGE READING

Pressing “UP” button in time of displaying phase neutral voltage reading phase –phase voltage reading are displayed simultaneously within the range of 0-500 V “ V L-L (V)” indicates this reading.

6. FREQUENCY READING

Pressing “UP” button in time of phase-phase voltage reading the frequency of phase being connected into terminal “R” is displayed within the range of 45-70 Hz. “FRQ (Hz) indicates this reading.

7. DEVICE STATUS INDICATION

It is a menu giving information about the operational status of device. Each stage of the below given demonstrates system / network informations and their updates

a- “st1” Control Mode (Check Mode): Used for the verification of terminal connections and application correctness at an initial period of operation or in following to “RESET” application.

b- “st2” (Learning Mode) : used for collection of data (informations) for the system recognition by learning. This application is a composition of ever repeated number of signal measuring operations and

their cyclic analysis. After the completion of this stage , a data base containing typical characteristic of system in use is formed by the consequences of analytical process.

c- "st3" (Improvement) : After "Learning Stage" completed. Device shall automatically start trying to improve the system relevant to modeling. All informations and data are processed so as to be used for making decision on system. The main difference in between this operation and learning mode is that of the system status evaluation within the mode of improvement.

d- "st4" (Monitoring) : After "improving stage" completed, monitoring mode is auto shifted. As it would already known, informations and data were received, processed and the parameters to be required were determined. At monitoring stage, system should be monitored and input data be tested via the receipt of current and voltage signals.

e- "st5"(Update) : While the changes on system are on stage of re-introduction, update mode is activated. Update activation is recommended in every after maintenance for better performance. At the end of update stage. Monitoring will be followed in "st4" mode.

8. CONTACT POSITION ACCORDING TO THE FAILURE

Protection relay (NC, C, NO) will be non-energized if provided that the current and voltage values of all phase are in between adjusted protection limit and no detective warning at a time of initial energizing.

For Detective Property : If one of the early warning condition occurrs, relay output will change contact position.

For Voltage Protection : Voltage protection relay will be energized and its relay contact will change the position at the end of the adjusted time delay if one of the measured value of voltage go over or under the voltage protection limit.

For Current Protection : Current protection relay will be energized and its relay contact will change the position at the end of the adjusted delay time if one of the measured values of current goes over or under the current protection limit.

Current and voltage protection relays are independently switched on/off. As shown on Figure 1, NC, C, NO indicate relay contacts aimed for the display of current/ voltage failures. If Alarm LED is lightening continuously, it means that there is a current or voltage failure conditions. If Alarm LED is making blink, it means that Digital Condition Monitor/True RMS Multimeter can not take data from the system or system is stopped.

9. ERROR INDICATIONS

Faults indication with the LEDs built on the front right corner are displayed under a real time-clock precision. LEDs statuses are here below explained as.

a- "NORMAL" LED "ON" indicates system works O.K. and matches data as per the referred model.

b- "WATCH LINE" LED "ON" indicates a difference in between data being obtained and the referred model. Hence a variation probability on the system network line in use may be possible and this may be not introduced to the device.

c- "WATCH LOAD" LED "ON" indicates a substantial difference in between data being obtained and the referred model. Hence a variation probability on the system load in use may be considered and this may be not introduced to the device.

d- "PERFORM MAINTENANCE" LED "ON" indicates a serious difference in between data being obtained and the referred model due to development of a fault on the running system. A technician must be called to perform maintenance.

e- "STOP" LED "ON" indicates a severe difference in between the datas being obtained and the referred model due to development of a serious error occurrence. System should have to be stopped.

g- None of any LED "ON" indicates no sufficient data's been received. In case of continuity of problem, getting in contact with the manufacturer is essential.

10. TECHNICAL SPECIFICATIONS

Operating Voltage(Un)	220VAC ± 20% (L-N) (120VAC is optional)
Operating Frequency	50/60 Hz
Power Consumption	< 4VA
Input Power Consumption	< 1VA
Measurement Range	0-300VAC (L-N) 0-500VAC (L-L)
Primary Current	5…9500A
Secondary Current	50mA…5.5A
Frequency Measurement Range	45-70 Hz
Accuracy	+/-1%
Alarm Output	Relay Output-250VAC/5A
Display	7 Segment LED display
Operating Temperature	-25^{o}C … +65^{o}C
Mounting Type	Panel Mounted
Dimensions	96x96x73 mm
Protection Class	IP 20
Cover Material	V0
Cable Type	2.5 mm^2

11. SAFETY & WARNING INSTRUCTIONS

- Turn off power during connection/wiring.
- Check correct mains voltage/wiring terminal.
- Installation shall only be performed by qualified personnel.
- Do not use any solvent or alike for cleaning.

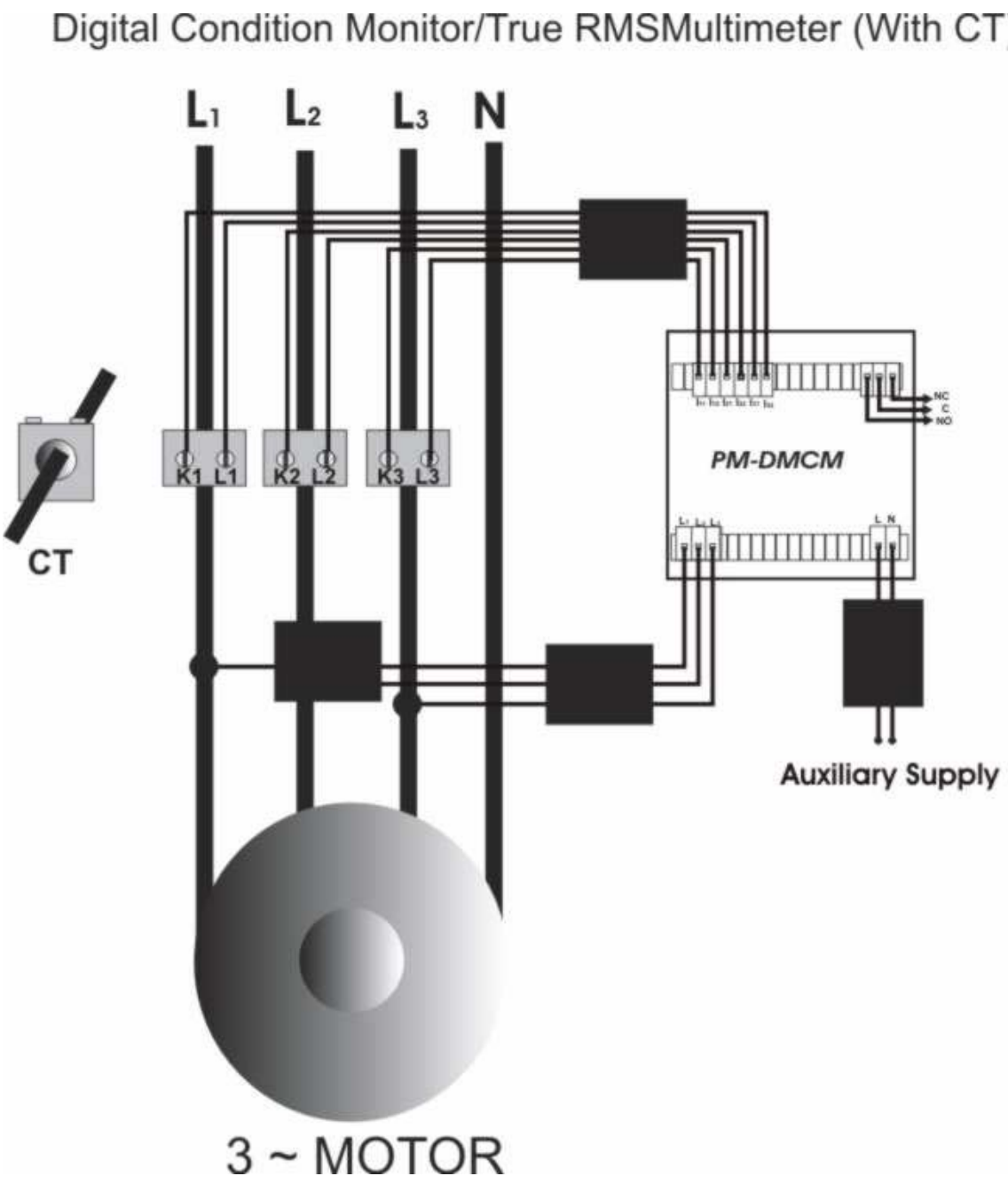

Figure1: Connection Diagram with CT

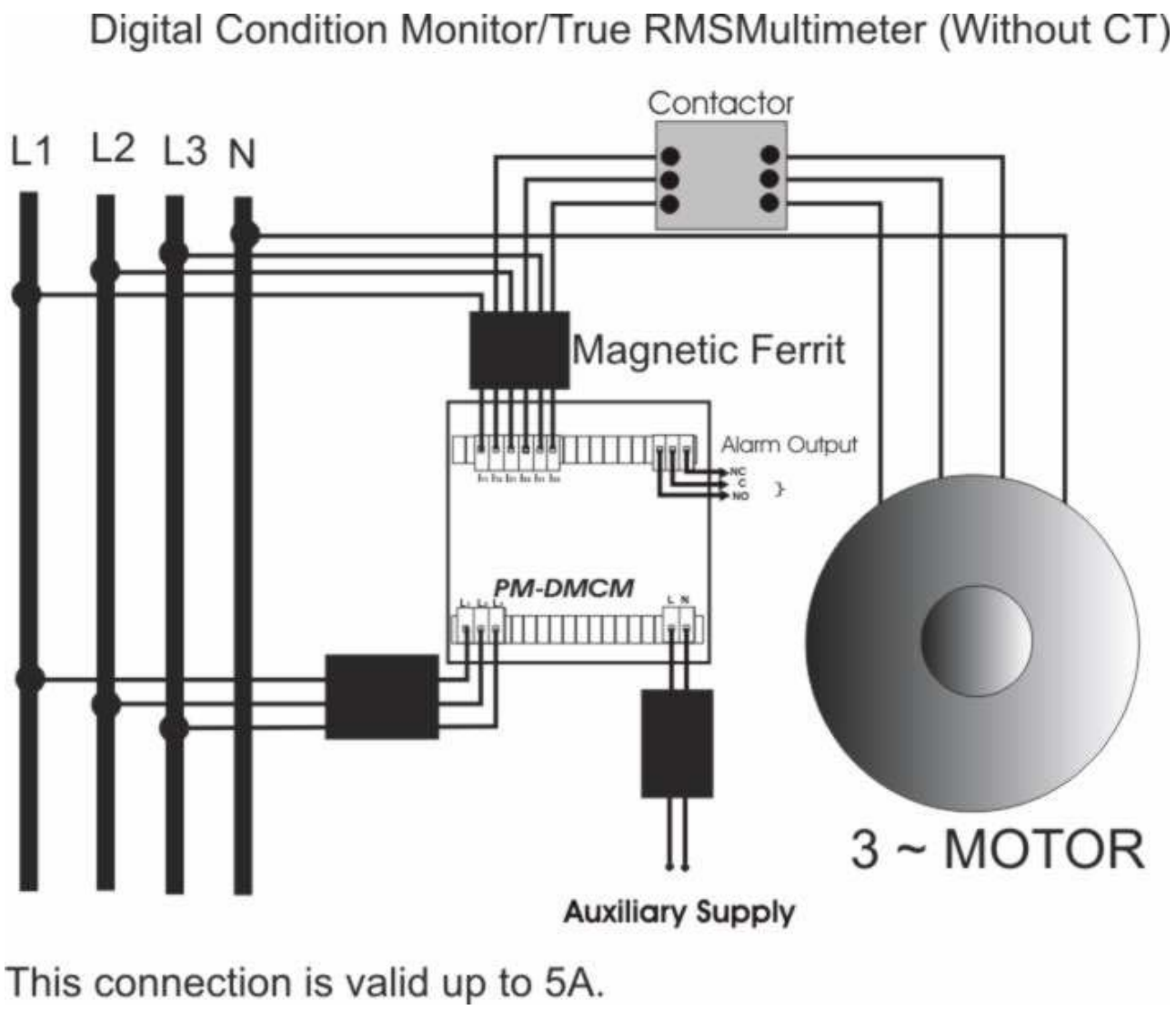

Figure 2: Connection Diagram without CT

INTER ELECTRIC-ELECTRONIC IND.CO. LTD.
Namik Kemal Mh. Adile Nasit Blv. 139. Sok. No:4 Esenyurt – ISTANBUL/TURKEY
Tel: + 90 212 699 77 99 Faks: + 90 212 620 95 69
Web: www.intertime.com.tr E-Mail : inter@intertime.com.tr