Andhra Pradesh State Skill Development Corporation

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Basics of induction Motors

SIMOCODE and its components

SIMOCODE:

1. How can faults in automated processes and costly plant downtimes be prevented?

2. What is the best way to avoid faults in your system or detect pending errors at an early stage?

Our answer: Smart motor management with SIMOCODE pro – a reliable partner since 1986.
SIMOCODE pro is the flexible and modular motor control system for low-voltage motors. It can easily and directly be connected to automation systems via PROFIBUS or PROFINET and covers all functional requirements between the motor starter and the automation system – including the fail-safe disconnection of motors. Further, SIMOCODE pro combines in just one compact system all required protection, monitoring, safety and control functions. The motor management system thus helps you to increase the process control quality and reduce costs at the same time – from planning through installation right to operation or service of a plant or system.

The conventional motor feeder generally have:

- MCC room for placing the starter hardware and running the power cables from the starter to the motor actual location.
- From the marshalling chamber all the cables are connected to one communication cable.
- The communication cable is connected to a I/O module of a PLC.
- From the I/O module the communication cable is taken to the PLC or DCS.

There were many draw backs for the conventional feeders:
Some of them are…

- Only basic protections can be given to the motor.
- Length of the wire required for the control wiring is more.
- Control wiring complication.
- Space required in the panel board is more.
- Only few ONs and OFFs can be allowed.
- Contunoous supervision required.

SIMOCODE pro is a flexible, modular motor management system for motors with constant speeds in the low-voltage performance range. It optimizes the connection between I&C and motor feeder, increases plant availability and allows significant savings to be made for startup, operation and maintenance of a system.

SIMOCODE pro offers, for example:

1. Multifunctional, solid-state full motor protection which is independent of the automation system
2. Integrated control functions instead of hardware for the motor control
3. Detailed operational, service and diagnostics data
4. Open communication via PROFIBUS DP, PROFINET/OPC UA, Modbus RTU or EtherNet/IP

5. Safety relay function for the fail-safe disconnection of motors up to SIL 3 (IEC 61508, IEC 62061) or PL e with Category 4 (EN ISO 13849-1)
6. SIMOCODE ES is the software package for SIMOCODE pro parameterization, start-up and diagnostics.

General Benifits:

1. Integrating the whole motor feeder into the process control by means of PROFIBUS DP, PROFINET/OPC UA, Modbus RTU or EtherNet/IP significantly reduces the wiring between the motor feeder and the PLC.
2. Decentralization of the automated processes by means of configurable control and monitoring functions in the feeder saves resources in the automation system and ensures full functionality and protection of the feeder even if the I&C or bus system fails
3. The acquisition and monitoring of operating, service and diagnostics data in the feeder and process control system increases plant availability as well as maintenance and service-friendliness.
4. The SIMOCODE pro system offers functionally graded and space-saving solutions for each customer application
5. The high degree of modularity allows users to perfectly implement their plant-specific requirements for each motor feeder
6. The replacement of the control circuit hardware with integrated control functions decreases the number of hardware components and wiring required and in this way limits stock keeping costs and potential wiring errors.
7. SIMOCODE pro has been managing constant-speed, low-voltage motors for 50 years. It provides comprehensive protective, monitoring, and control functions. Enjoy the benefits of detailed operating, servicing, and diagnostics data – also for fail-safe disconnection of motors.
8. SIMOCODE 3UF1 has starter in the year 1986 with 'Sinec L2' as the protocol. Then, in the same year 3UF2 with 'Profibus FMS (field messaging system)' protocol is introduced.
9. In the year 1996 SIMOCODE DP (decentralized perpherals) 3UF5 is introduced. Then, in the year 2004 SIMOCODE pro 3UF7 with Profibus DP is introduced to the market.
10. Overall, SIMOCODE is having more that 30 years in the industries. Thanks to the intelligent motor management system.

Two series of devices: SIMOCODE pro C and pro V.

The SIMOCODE pro system has two series of devices:

SIMOCODE pro C – a compact solution and SIMOCODE pro V – the series of devices that can be flexibly expanded. And SIMOCODE pro V is especially versatile. Depending on the requirement, its functionality can be simply extended, e.g.

- The number and type of the digital inputs and outputs can be increased step-by-step and adapted.
- A current/voltage measuring module can be used to additionally detect the voltage and to monitor power dependent measured quantities.
- Several analog temperature sensors can be evaluated using a temperature module.

- In addition, an earth fault detection can be integrated in conjunction with a summation current transformer.
- An analog module extends the system by an additional analog input and output.

Features of SIMOCODE:

- 45 mm wide
- Removable current transformer
- Voltage, power and cos phi*
- Temperature detection (Pt100/Pt1000)
- Analog input and output (0/4–20 mA)
- Graphic parameterizing interface
- Overlapping current range from 0.3 A
- Voltage detection up to 690 V
- Memory module to parameterize the device without a PC/PG
- Addressing plug to assign the PROFIBUS address
- Automatic baud rate detection, 12 Mbps
- All of the phase currents can be evaluated
- New control functions
- 110–240 V AC/DC wide-voltage range
- Measuring curves can be recorded

… and much, much more!

SIMOCODE pro C

- Current measuring module
- Basic unit
- Operator panel

SIMOCODE pro V

- Current measuring module
- Basic unit
- Operator panel
- Thermistor connection
- Digital modules
- Earth leakage protection
- Analog module

As seen, SIMOCODE pro V is the advanced version of the SIMOCODE series.

COMPONENTS:

Current ranges of the current measuring modules:

The current measuring function is now separate from the basic unit, which means that the device can be far more flexibly integrated into the motor feeder. The main circuit can be easily located somewhat distant from the control circuit by using a connecting cable up to 2 m long. This means that SIMOCODE pro can also be used when space is very restricted. What is especially new and interesting are the wider current ranges from 0.3 A that now have a far greater overlap. Now, there is also a new option for the basic unit for SIMOCODE pro V – instead of the current measuring modules, the new current/ voltage measuring modules1) can be used. This means that additional voltages up to 690 V can be detected in the main circuit and, for example, power-related measured quantities can be monitored.

The Basic Unit:

The basic units are used for both series of devices. One of the essential new features is the fact that the width has almost been halved with respect to the previous unit and is now only 45 mm wide. This of course saves a lot of space. The new wide voltage range (110–240 V AC/DC) for the power supply voltage provides a higher degree of flexibility in addressing applications. The integrated thermistor connection was consequentially kept. This means that additional evaluation units are not required. The features already known from SIMOCODE-DP – such as the four digital inputs with internal 24 V DC supply, the three monostable relay outputs and the PROFIBUS DP connections are also included in both basic units.

Operator Panel:

Half the time – the same width … but far more efficient: With dimensions of only 36 x 96 mm, the new operator panel can replace five conventional push buttons and ten indicator lights. It now has four freely assignable push buttons and seven LEDs that can be freely used. This means that the new operator panel is now packed with even more functions and at the same time saves up to 50 % space with respect to its predecessor.

Digital Module:

Just the same as for SIMOCODE-DP, additional digital inputs or relay outputs can be added when required to the SIMOCODE pro V basic unit. These can then be assigned to any function in the system. Contrary to SIMOCODE-DP, this can now be realized in two stages using up to two 22.5-mm wide digital modules.

Put another way: With SIMOCODE pro, only 50 % of the space is required when completely replacing a SIMOCODE-DP expansion module! Further, the versions listed below, can be flexibly combined and used with the same basic unit:

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Digital module: digital inputs, externally supplied with 24 V DC and two monostable relay outputs

- Digital module: digital inputs, externally supplied with 110–240 V AC/DC and two monostable relay outputs.
- Digital module: digital inputs, externally supplied with 24 V DC and two bistable relay outputs.
- Digital module: digital inputs, externally supplied with 110–240 V AC/DC and two bistable relay outputs.

Different parts available with basic unit are:

- Digital inputs.
- Relay outputs.
- LEDs for status display.
- Test/reset button to reset the program.
- Input supply terminals.

- Connecting terminals for current measuring module.
- PROFIBUS DP port.
- System interface,
- Thermistor connection terminals.

SIMOCODE pro supplies a large amount of detailed operating, service and diagnostics data:

Operating data:

- Motor switching state (ON, OFF, LEFT, RIGHT, SLOW, FAST), derived from the current flow in the main circuit: thus, feedback via auxiliary contacts of circuit breakers and contactors is not necessary.
- Current in phases 1, 2 and 3 and maximum current in % of set current
- Voltage in phases 1, 2 and 3 in V
- Active power in W
- Apparent power in VA
- Power factor in %
- Phase unbalance in %
- Phase sequence
- Ground-fault current
- Temperature in the respective sensor measuring circuits, and maximum temperature in K
- Actual analog signal values
- Time to trip in s
- Temperature rise for motor model in %
- Remaining cooling down period of the motor in s, etc.

It is possible to adapt the units via the device-internal conversion of individual measured values with the help of the logic modules (calculators) provided by SIMOCODE pro V PN.

Service data:

Among other things, SIMOCODE pro provides the following relevant data for maintenance:

- Number of motor operating hours, also resettable
- Motor stop times, also resettable
- Number of motors starts, also resettable
- Number of permissible starts remaining
- Number of overload trips, also resettable
- Feeder power consumption in kWh, also resettable
- Internal feeder-related comments stored in the device, e.g. information regarding maintenance events, etc.
- Safety-related tripping monitoring in h, also resettable.

Diagnostics data:

- Numerous detailed early warning and fault messages, also for further processing in the device or in the control system
- Device-internal error logging with time stamp
- Value of the last trip current
- Feedback faults (e.g. no current flow in the main circuit after switch-on command), etc.
- "Local" and "PROFIsafe" diagnostic messages