Technical collection

How to shed non-priority loads with a Masterpact circuit breaker?

Equipment, diagrams and configurations required for the load-shedding function

Application note

Schneider Electric

Introduction

Load-shedding is one of the active energy efficiency actions.
Load-shedding, i.e. preventing some non-priority loads from being supplied during a certain period of time, can be used to supply power to an entire electrical installation by subscribing to the most appropriate contract possible with the electricity distributor, thereby saving money.
The advantages of energy efficiency are:

- lower consumption
- cost optimisation
- improved availability

Nowadays, this involves all the energy consumers: industries, buildings, shops or individuals.

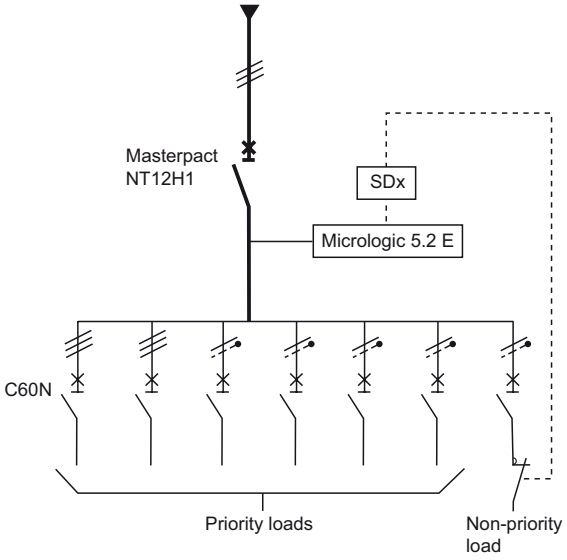
Load-shedding is used to:

- prevent overload tripping: if the load approaches the maximum load threshold, a load-shedding order on previously selected loads will prevent a general power failure throughout the installation (improved availability)
- subscribe to a lower level contract, whilst still guaranteeing that all the devices operate correctly
- carry the consumption forward to an off-peak tariff period (cost optimisation).

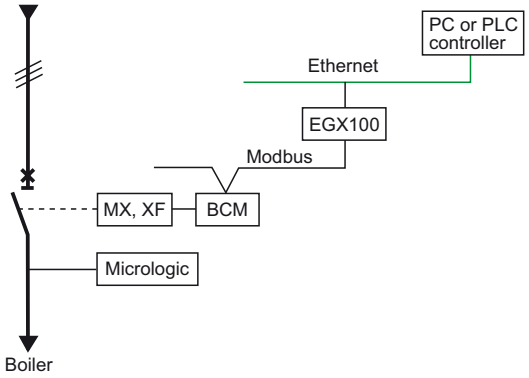
Two load-shedding solutions are provided:

- "reflex" load-shedding via a local order
- "centralised" load-shedding via a remote order

Reflex load-shedding



Centralised load-shedding

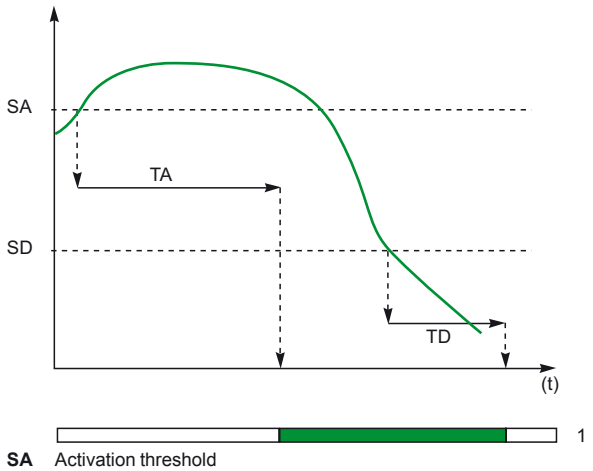


1. "Reflex" load-shedding via a local order

Description

The "reflex" load-shedding order is generated by the Masterpact circuit breaker itself via the Micrologic electronic trip unit. In fact, the Micrologic P electronic trip unit (energy measurement) is used to manage alarms based on the monitoring of electrical variables such as the instantaneous current, the demand power (Pdmd) or even the frequency.
An activation (pick-up) threshold (SA) with its time delay (TA) and a deactivation (drop-out) threshold (SD) with its time delay (TD) are associated with each alarm. The time delays are independent and can be set from 1 s to 3000 s.

The following figure illustrates the high alarm activation condition:



SA Activation threshold
TA Activation time delay
SD Deactivation threshold
TD Deactivation time delay
1 Alarm: activation zone (green)

Example 1: Load-shedding based on the instantaneous current threshold on a phase.
The detection of an instantaneous current high threshold overrun on a phase indicates an overload on this phase. Shedding a single-phase load connected to this phase prevents the circuit breaker from tripping on overload (long time delay) and therefore improves availability.

Example 2: Load-shedding based on a total demand power threshold (Pdmd).
The detection of an demand total power high threshold overrun indicates an overload on this installation. Load-shedding prevents the subscribed power from being exceeded and therefore optimises costs.

Example 3: Load-shedding based on frequency threshold (f).
The detection of a network frequency low threshold overrun in the event of the installation being operated by a diesel generator indicates an imbalance between the demand and the capacity of the generator. Load-shedding makes it possible to redress the balance and therefore to improve availability.

After configuring the thresholds, all that is required is to assign the alarm to one of the outputs of the M2C module.

M2C.

The "reflex" load-shedding order is therefore sent to the load-shedding contactor via the SDx module installed in the Masterpact circuit breaker.
This load-shedding contactor (2-pole NC) cuts off the non-priority feeders.
This solution is therefore very easy to implement.

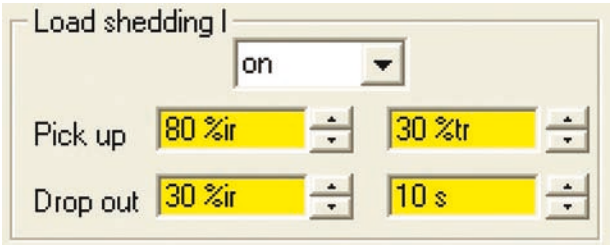
Products used

Product	Description
Masterpact NT12H1	Three-pole air circuit breaker
Micrologic	Electronic trip unit with energy measurement: Micrologic 5.0 P
SDx	Two-output module
CT	Three-pole contactor 185A

Configuration

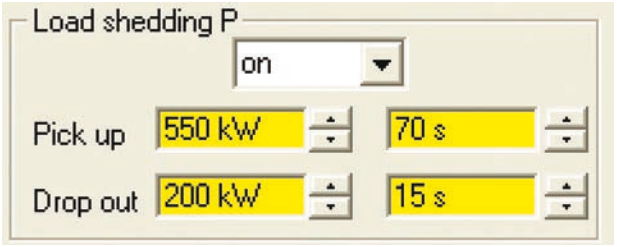
The alarms are configured using the RSU software (downloadable from schneider-electric.com)

Example 1: Load-shedding based on the current threshold.



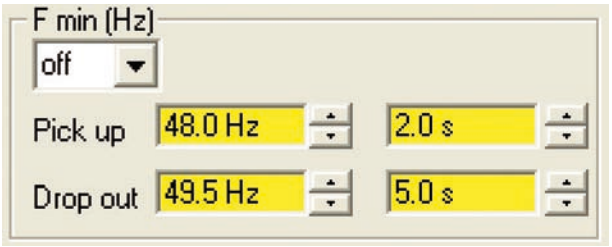
The load-shedding order is given as soon as current on one of the three phases exceeds 80%Ir for more than 30%tr.
This order will be maintained as long as the current does not fall below 30%Ir for more than 10 s.
Note: To avoid beat phenomena, it is recommended that the difference between the high threshold 80%Ir and the low threshold 30%Ir should be greater than the current consumed by the shed load.

Example 2: Load-shedding based on a total demand power threshold (Pdmd).



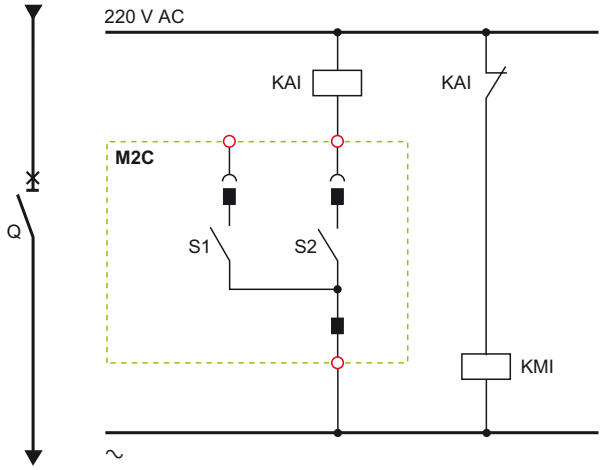
The load-shedding order is given as soon as the total demand power exceeds 550 kW for more than 70 s. This order will be maintained as long as the total demand power does not fall below 200 kW for more than 15 s.

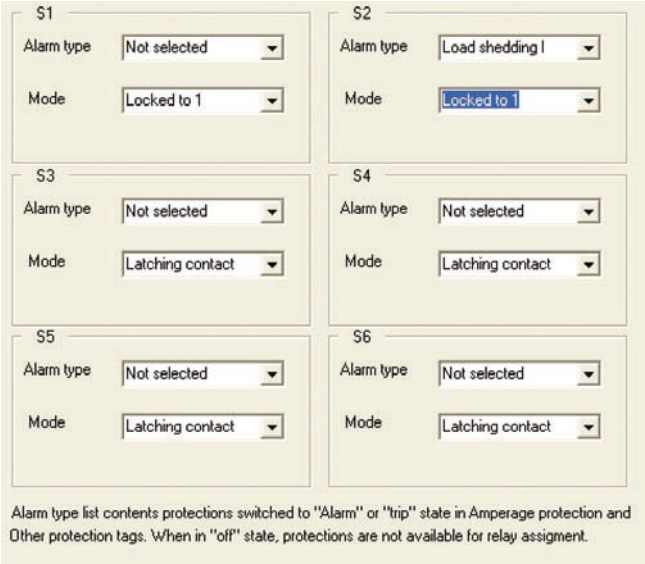
Example 3: Load-shedding based on frequency threshold (f).



The load-shedding order is given as soon as the frequency falls below 48 Hz for more than 2 s. This order will be maintained as long as the frequency does not rise above 49.5 kW for more than 5 s.

Diagram





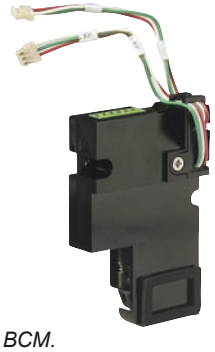
Test

It is easy to test whether the reflex load-shedding solution has been implemented by using the LSU (Local Simulation Utility) software. This software, which is available from schneider-electric.com, can be used to change to 1 the output 2 of the M2C module

2. "Centralised" load-shedding solution via a remote order

Description

The "centralised" load-shedding order is generated by the controller (PC or PLC).
The controller is used to generate load-shedding orders based on monitoring the electrical variables of the entire electrical installation, taking the time bands, operating constraints or even process-related information into consideration.
The "centralised" load-shedding order is sent to the BCM module installed in the Masterpact circuit breaker via the Modbus communication network.



BCM.

The BCM module is itself connected to the communicating MX or XF voltage releases, which are the actuators that open or close the Masterpact circuit breaker.

This a powerful and flexible solution.

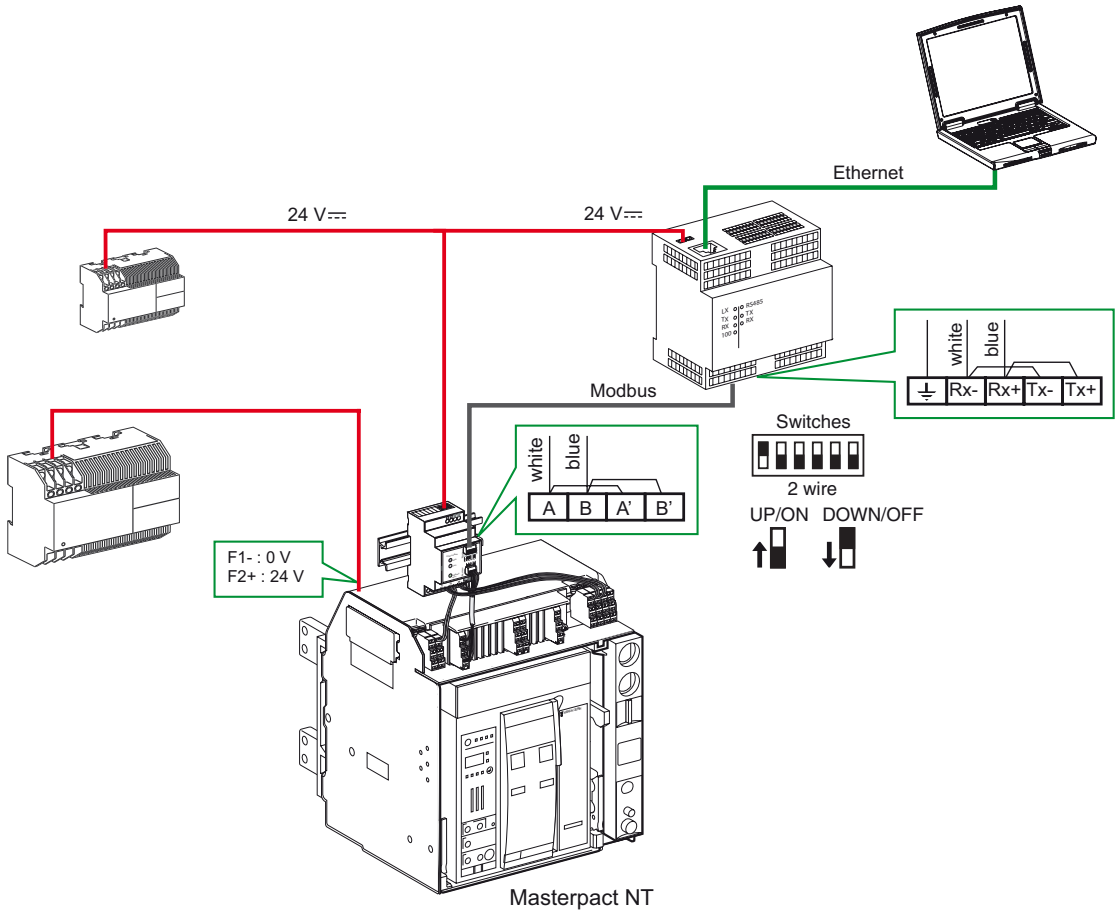
MX or XF voltage releases .

Products used

Product	Description
Masterpact NT12 H1	Three-pole circuit breaker
Micrologic	Electronic trip unit
BCM	Breaker Control Module
MX	Closing release
XF	Opening release
EGX100	Modbus/Ethernet communication gateway

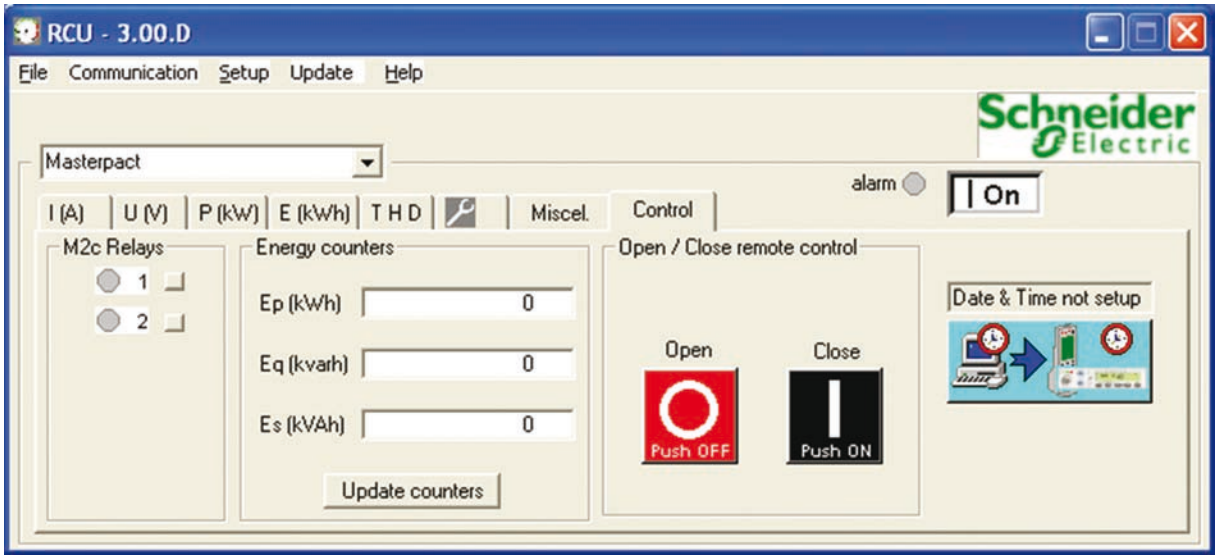
Configuration

No special configuration for the Micrologic. The load-shedding order (circuit breaker opening/closing) is sent by the controller to the BCM module via the Modbus network. The configuration of the BCM module Modbus circuit breaker opening/closing orders is specified in the Modbus communication option operations guide (comBT32AM_EN.pdf).



Test

It is easy to test whether the centralised load-shedding solution has been implemented by using the RCU (Remote Control Utility) software. This software, which is available from www.schneider-electric.com, can be used to open/close the Masterpact circuit breaker via the communicating voltage releases MX or XF. Connection to the PC Ethernet port is via the Modbus/ Ethernet EGX communication gateway.
In the main set-up menu, go to the User profile submenu and choose "control". The control tab is now available and can be used to check that the communicating remote control is operating correctly over the Modbus network.



Conclusion

The "reflex" load-shedding solution via a local order with Masterpact provides:

- a reduction in capital expenditure, as its purchase price is lower than that of a traditional solution: the cost of a Masterpact with a Micrologic P trip unit (energy measurement) + M2C module is similar to the cost of a Masterpact without the measurement function + Power Meter + I/O + CT. The difference is the cost of installing/ wiring/testing the CTs, which is included in the Masterpact.
- a reduction in operational expenditure, due to optimised energy costs and to the improved availability provided by the load-shedding function.

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