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13. Alarm handling

The alarm handler is a software function, which handles all alarms registered by the DELOMATIC system.

The alarm handler may be activated by:

- External alarm signals
- Internal DGU system supervision
- Internal generator set supervision
- Internal PMS supervision

The alarm handler will examine every registered alarm, activate the designated alarm sequence and display the corresponding alarm message. For more information about the significance of a specific alarm message, please refer to the alarm list.

When a new alarm is registered:

- **"ALARM"** LED will start flashing red
- Alarm message will be displayed at the DU
- Alarm sequence will be carried out

Display of alarms

Alarm messages concerning a *specific generator set* (DGU) will be displayed at the corresponding DU.

Alarm messages concerning *common PMS functions* will only be displayed at the corresponding DU for the Main PMS DGU. (Please refer to paragraph *ALARM LIST* for details regarding alarms).



Alarm types

The alarm handler distinguishes between system alarms and PMS alarms.

System alarms (system supervision)

A system alarm indicates a failure, which may prevent the DGU from operating as expected. A system alarm may be caused by communication error, power supply failure or input/output error and similar.

(For more information on how to handle a system alarm, please refer to paragraph *GENERATOR SET PROTECTION* or paragraph *SERVICE GUIDE*.)

PMS alarms

A PMS alarm may be considered to be caused by a "normal" event, meaning that the DELOMATIC system is fully operational and handling the event(s) as expected.

Alarm sequences

The alarm sequences are designed to take appropriate action according to the severity of the event, which caused the alarm.

The DELOMATIC system is implemented with several alarm sequences:

- Warning
- DG block
- Prewarning/Safety stop
- Trip of GB
- Shutdown
- Short circuit (no blackout start)
- DG Trip of TB

Warning

The purpose of the warning sequence is to inform the operator of "nice to know" events. The DELOMATIC system will not take any action, but only display an alarm message.

Warning sequence functions will

- make the *red* "**ALARM**" LED flash
- display the designated alarm message at the DU
- activate the horn output
- set one of the alarm type outputs (SYSTEM or PMS)

The operator is able to reset the horn output by pressing the "**RESET HORN**" push-button (optional). This will not have any influence on the further alarm handling.

DG/SG block

The DG/SG block alarm sequence is used for blocking of any further automatic functions, which will lead to connection of the generator set/shaft generator, if a situation (electrical or mechanical) occurs due to which it is inadmissible to connect the generator set/shaft generator to the busbar.

DG/SG block sequence common functions will

- carry out the warning sequence
- block all automatic functions, which will lead to a connection of the generator set/shaft generator
- block for closing of the generator/shaft generator breaker in question. (The DG/SG block sequence will not open or trip the generator breaker, if it is already closed when the block alarm becomes active)

Additional to the common functions the **DG block sequence** will

- transfer the PMS start command to the next stand-by DGU

Additional to the common functions the **SG block sequence** will

- automatically cancel the SG plant mode and select the AUTOMATIC plant mode

Prewarning/Safety stop

The Prewarning/safety stop sequence is used to carry out a previous intervention and stop a defective engine, instead of waiting until a critical condition becomes fatal for the engine. (Not in SEMI-AUTO mode).

Furthermore, the prewarning/safety stop alarm sequence can prevent a possible blackout situation at the busbar, because it replaces the defective generator set *before* a shutdown occurs on a running generator set.

The prewarning/safety stop sequence starts and connects the next stand-by generator set to the busbar according to the chosen start priority. When sufficient available power is measured at the busbar, the defective generator set is disconnected and stopped (incl. cooling down etc.).

The **Prewarning/Safety stop sequence** functions will

- carry out the warning sequence (alarm message causing the situation)
- transmit a PMS start command to the next stand-by generator set
- connect the next stand-by generator set to the busbar
- display alarm "Safety stop" on the DU for the defective DG
- disconnect and stop the defective generator set (incl. cooling down etc.)
- block for a new start of the defective DG
- carry out the blocking alarm sequence

If the defective DGU is not ready for PMS stop, the alarm message "Safety stop" is not displayed and the DG is not stopped either.

Trip of GB/SGB

The Generator Breaker/Shaft Generator Breaker sequence is carried out in order to protect the generator set/shaft generator from critical electrical conditions on the busbar, or to protect the busbar from critical electrical conditions in the generator set.

The **GB/SGB trip sequence** common functions will

- immediately open the generator/shaft generator breaker
- disconnect the non essential load groups (NEL)
- carry out the warning sequence
- block for a reconnection of the generator set/shaft generator to the busbar, until the alarm is acknowledged

Additional to the common functions the **DG trip sequence** will

- transmit a PMS start command to the next stand-by generator set
- continue idle run of the defective generator set

Additional to the common functions the **SGB trip sequence** will

- automatically cancel the SG plant mode and select the AUTOMATIC plant mode

An active trip of SGB alarm sequence is indicated by

- a red "**CB ON**" LED at the DU

Shutdown

The shutdown alarm sequence may be carried out, when a fatal condition has occurred in the generator set.

The **Shutdown sequence functions** will

- immediately open the generator breaker
- shut the engine down immediately after disconnecting the breaker from the busbar
- disconnect the non essential load groups (NEL)
- carry out the warning sequence
- transmit a PMS start command to the next stand-by generator set
- block for a new start of the defective generator set until the alarm is acknowledged

DG trip of TB

The trip of Bus Tie Breaker sequence is carried out in order to protect the system from critical electrical conditions on the busbar. A high forward or reverse reactive load on a generator can be used to trip the bus tie breaker and keep the malfunction on only one busbar. Otherwise the malfunction will influence the total Power Generating system.

The **DG trip TB sequence functions** will

- immediately open the tie breaker
- carry out the warning sequence
- block for a reconnection of the tie breaker

TB/SC block

The TB/SC block alarm sequence is used for blocking of any further automatic functions which will lead to connection of the tie breaker/shore connection, if a situation (electrical or mechanical) occurs due to which it is inadmissible to connect it.

The **TB/SC block sequence** functions will

- carry out the warning sequence
- block for all automatic functions, which will lead to a connection (the TB/SC block sequence will not open or trip the breaker if it is already closed, when the block alarm becomes active)

Trip of TB/SC

The trip of Tie Breaker/Shore Connection sequence is carried out in order to protect the tie breaker/shore connection from critical electrical conditions on the busbar, or to protect the busbar from critical electrical conditions in the shore connection.

The **TB/SC trip sequence** functions will

- immediately open the tie breaker/shore connection breaker
- carry out the warning sequence
- block for a reconnection of the tie breaker/shore connection to the busbar

Alarm registration

All alarm messages are registered and stored in the alarm stack with statement of

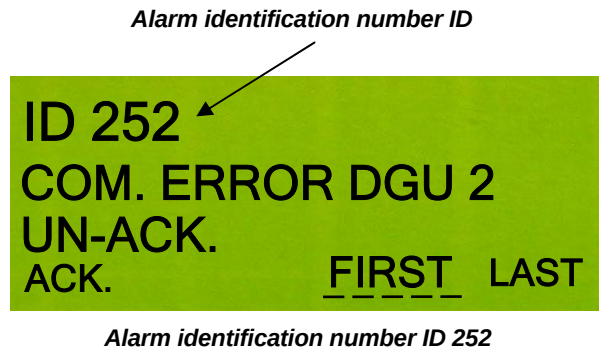
- status as first or not first received alarm
- status as an unacknowledged or acknowledged alarm

Alarm stack

The alarm handler stores all registered alarm messages in chronological order (as registered by DELOMATIC) in the alarm stack. The received alarms will be stored with the first (oldest) alarm at the top of the stack. If more than one alarm is active, it is possible to toggle through the alarm list using the “” or “” push-buttons on the display. The alarm information window displays one alarm at a time and whether or not it is acknowledged. If it is unacknowledged, press the “ACK” push-button to acknowledge it. Use the “” or “” push-buttons to step through the alarm list.

Alarm ID. no.

Every alarm in the DELOMATIC is identified by an alarm identification number ID, which will be displayed at the DU together with an alarm text. The alarm identification number is used for a positive identification of alarms, e.g. when corresponding with a DEIF service engineer. In the example below, the alarm for COM. ERROR DGU 2 is identified by the ID. no. 252.

**First alarm**

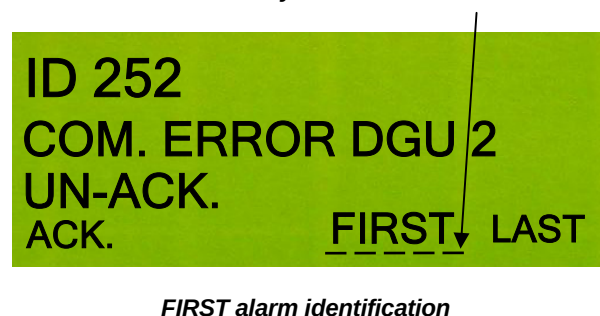
The first alarm status is designated to the first new alarm received by the DELOMATIC.

Some events may cause a chain reaction of further events, each generating an alarm. The first alarm status may indicate which event was the originating.

The alarm handler software is executed sequentially, which means that the status of the internal alarm signals is examined once in every program scan. If the DELOMATIC receives several internal alarm signals within one program scan, the alarm signal which was "scanned" first will be designated with the first alarm status.

Once the alarm stack only contains acknowledged alarms, the next new alarms registered will be designated with the first alarm status. This means that several "first alarms" may be registered in the alarm stack simultaneously.

First alarm is identified by the underscore below FIRST



Acknowledgement of alarms

Any alarm registered by the DELOMATIC system must be acknowledged by the operator in order to reset the action taken by the alarm sequence.

At the same time the operator becomes aware of any occurring abnormal events, even though the condition which caused the alarm may have disappeared as a result of the action taken by the DELOMATIC alarm sequence.

Every unacknowledged alarm is identified by

- "ALARM" LED flashing red
- the UN-ACK status line in the display

The UN-ACK status line in the display



```
ID 252
COM. ERROR DGU 2
UN-ACK.
ACK.      FIRST  LAST
```

UN-ACK alarm identification

An active alarm is acknowledged by pressing the "ACK" push-button on the DU.

Acknowledgement of a still active alarm is confirmed by the following status line in the display:

The ACK status line in the display



```
ID 252
COM. ERROR DGU 2
ACK.
ACK.      FIRST  LAST
```

ACK alarm identification

When only acknowledged alarms are present in the alarm stack, then

- the "ALARM" LED will turn to a steady red light

Acknowledgement of active alarms

An active alarm means that the condition(s) which caused the alarm is (are) still present.

When the alarm condition(s) for an alarm with acknowledged status disappear(s), the alarm message will be removed from the alarm stack, and any action made by the alarm sequence is disabled.

Acknowledgement of inactive alarms

An inactive alarm means that the condition(s) which caused the alarm has (have) disappeared before acknowledgement of the alarm. The acknowledgement of an inactive alarm will remove the alarm message from the alarm stack and disable any actions taken by the alarm sequence.

An empty alarm stack

When there are no unacknowledged alarms and no more active alarms

- the **"ALARM"** LED will be turned off
- the **alarm output(s)** will be deactivated (PMS or DGU alarm outputs)