

Power systems



Operation Manual

Operator Documentation.

Table of contents

TABLE OF CONTENTS	2
1. MODE SELECTION	3
1. OPERATION MODE AUTOMATIC.....	3
2.1. AUTOMATIC CONTROL IN STAND ALONE ISLAND	3
2.2. AUTOMATIC CONTROL IN MULTIPLE ENGINE ISLAND.....	4
2.3. AUTOMATIC CONTROL IN PARALLEL WITH UTILITY	5
2. OPERATION MODE OFF	6
3. OPERATION MODE HAND OFF LOAD	6
4. OPERATION MODE HAND LOAD.....	6
4.1. HAND LOAD CONTROL IN STAND ALONE ISLAND	6
4.2. HAND LOAD CONTROL IN MULTIPLE ENGINE ISLAND.....	7
4.3. HAND LOAD CONTROL IN PARALLEL WITH UTILITY	7
5. SELECTED MODE COMBINED WITH A MASTER.....	8
7. START UP SEQUENCE	9
7.1. ENGINE WAIT FOR RESET	9
7.2. WAIT FOR START	10
7.3. VENTILATION ENGINE ROOM (GAS ENGINE ONLY)	10
7.4. ENGINE PRE LUBE.....	11
7.5. ENGINE PURGE CYCLE (GAS ENGINE ONLY)	11
7.6. ENGINE START	11
7.7. ENGINE IDLE -> RATED.....	11
7.8. ENGINE STABILISATION	12
7.9. ENGINE WARMING UP	12
7.10. START UP PROTECTION	12
7.10.1 CLOSE CIRCUIT BREAKER.....	12
7.11. VOLTAGE MATCHING	13
7.12. SYNCHRONISATION	13
7.12.1 ENGINE OFF LOAD RUN.....	13
7.13. NORMAL OPERATION.....	14
7.14. STOPPING THE ENGINE.....	14
7.15. ENGINE RAMP DOWN.....	15
7.16. ENGINE COOL DOWN	15
7.17. OPEN GENERATOR CIRCUIT BREAKER	15
7.18. ENGINE STOPPING	16
7.19. WAIT FOR START	16
7.20. WAIT FOR START AFTER FAILURE	16
8. POWER FACTOR / VOLTAGE CONTROL	17
9. FREQUENCY / LOAD CONTROL	21
10. FAULT ANALYSIS	25
10.1. GENERAL ALARM INDICATION	25
10.2. ANALYZING ALARM (DIGITAL INPUT)	26
10.3. ANALYZING ALARM (ANALOGUE INPUT).....	31
10.4. USING THE ALARM SCREENS	36

This manual is describing both modes of operation and control philosophy. Although it might be possible that not all the modes are applicable, both parallel grid as well as island operation is described to give better insight.

1. Mode Selection

1=AUTOMATIC
2=OFF
3=HAND OFF LOAD
4=HAND LOAD



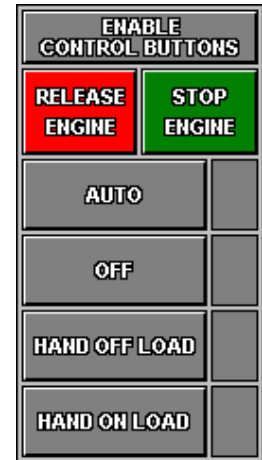
Option 1.bmp



Option 3.bmp



Option 2.bmp



Option 4.bmp

Selection mode can be done on 3 several ways:

Option 1: This is a 4 pole static key-switch and can be used to switch the installation in Automatic, Off, Hand Off Load or Hand Load operation. With this key-switch it is not possible to switch the installation in another mode by HMI (option 4), because it provides a static input. HMI will not overrule the static input. With a remote connection interference of a site operator is required to change from operation mode.

Option 2: This pulse key-switch can be used to switch the installation in Automatic, Off, Hand Off Load or Hand Load operation. With this key it is possible to change from operation mode by HMI (option 4).

Option 3: This key switch has the same functionality as the key switch at option 2; the difference is within the hardware. The inputs from the key switch are provided to an onboard print, as well as the output status LED's.

Option 4: This is a selection mode by HMI (Human Machine Interface), by pressing the Enable Control Buttons the installation can be switched in Automatic, Off, Hand Off Load or Hand Load operation. If option 4 is combined with option 1, the actual mode will be shown, but can not be changed.

1. Operation Mode Automatic

2.1. Automatic Control In Stand Alone Island

Start the engine

In automatic mode the engine will always start.

Control

The voltage and frequency will be controlled to the requested set-point set in the engine voltage / frequency controller. A stand alone engine has to pick up all load connected.

2.2. Automatic Control In Multiple Engine Island

Start the engine

In automatic control at least one engine will always run. Other engines will be started according to the total bus bar load. If the load is more then one engine can produce a second engine will be started according to the set start load at callout 1. If the load is less then the set stop load at callout 2, engines will be stopped.

	Start at		Stop at	
Number of engines	Load	Delay	Load	Delay
Run with 2 engines	900 kW	30.0 sec	500 kW	5.0 sec
Run with 3 engines	1800 kW	30.0 sec	1600 kW	5.0 sec
Run with 4 engines	2700 kW	30.0 sec	2500 kW	5.0 sec
Run with 5 engines	3600 kW	30.0 sec	3400 kW	5.0 sec

Start up with minimum amount of engines	2
Start up time minimum amount of engines	60.0 sec
Minimum amount of engines after start up	1
Maximum run time diff. between engines	1000 min
Maximum number of engines allowed to run	4
Sets running	0
Sets available	0
Re-initialise ats's on maximum engine load	
Average engine load	0 kW
Max. engine load	1360 kW
Wait time at max. engine load	5.0 sec

Engine seq.
1 st
2nd
3 th
4 th
5 th

Status	Engine Wait For Reset	Since	1 26 11	Site	Terberg Engine
Alarm	319:EMCP panel diagnostic failure	Number	39	Date	24/03/05 Time 14:18:36

Home Tree Prev. Page Next Page Reset Alarm Actual Alarm Edit

Bb1_sett.bmp

Control

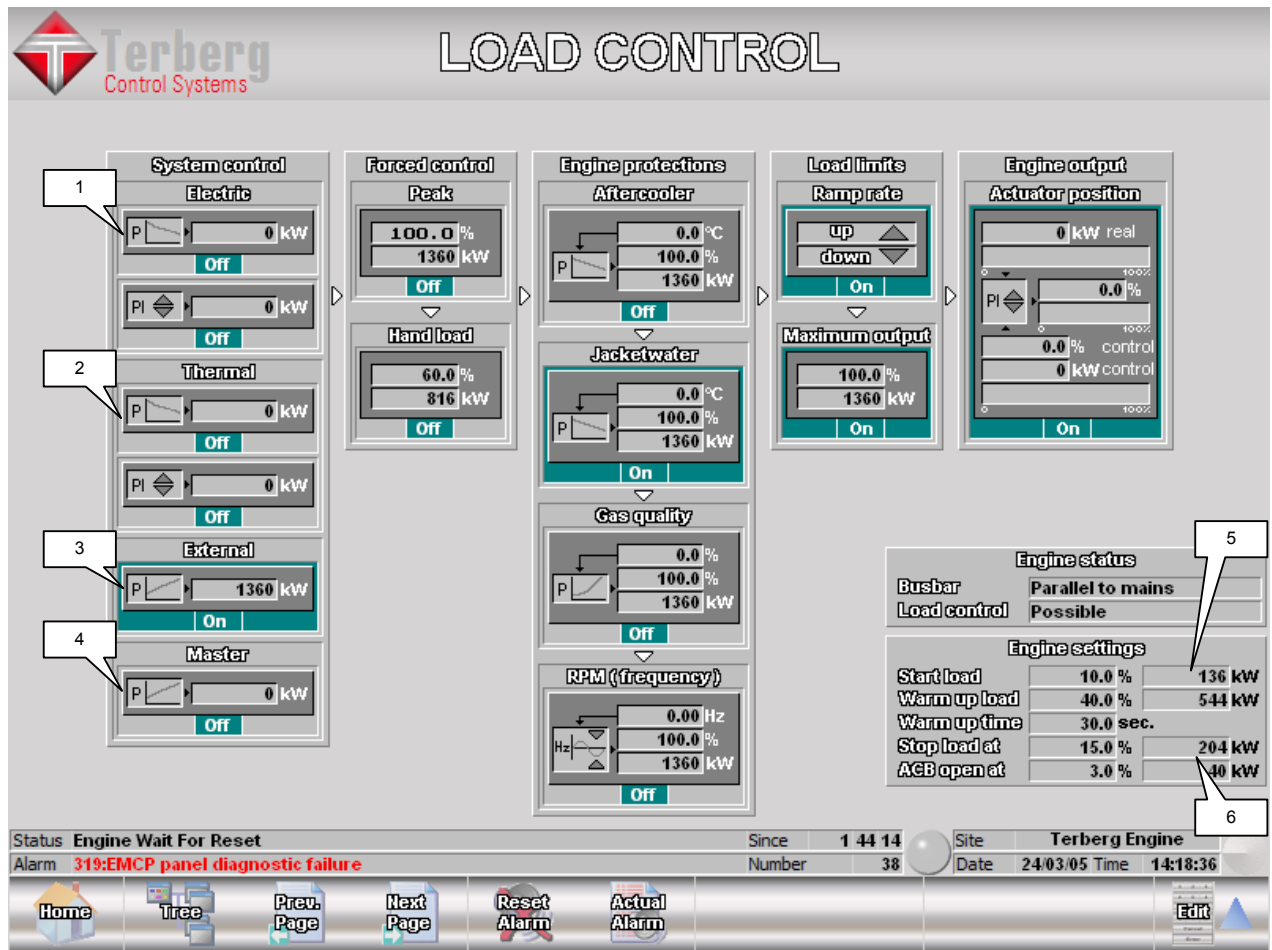
The voltage and frequency will be controlled to the requested set-point set in the engine voltage / frequency controller. Both real and reactive load will be shared among the running engines.

2.3. Automatic Control In Parallel With Utility

This mode of operation is only applicable if the engines are running in parallel with the utility.

Start the engine

In automatic the engine will start on load demand. The amount of load can be set by electric P / PI control (on imported load from the grid) see callout 1, thermal P / PI (on thermal system) see callout 2, external control (by BMS or any analogue input) see callout 3 or by master control (load request by master SBC via CAN 3 network) see callout 4. The engine will start when the load request is higher then the set start load at callout 5.



Ctrlldfrq.bmp

Control

The load and power factor will be controlled to the requested set-point set in the engine load / power factor controllers.

2. Operation Mode Off

The engine control is switched completely off, the engine can not and will not start in any circumstances. If the engine is running and when the key switch is switched to the off position, the engine will stop directly. The engine will not cool down and the generator circuit breaker will be opened, the auxiliary's will continue running during the pre defined auxiliary cool down time set in the process variables.

3. Operation Mode Hand Off Load

Start the engine

The engine can be started with the start button in the panel door (hardware) or by the start button in HMI (software). The engine will start running without any load, this mode is independent from island or parallel operation. Normal start sequence will be applicable until the step "start up protection".

Control

The voltage and frequency will be controlled to the requested set-point set in the engine voltage / frequency controller.

When the installation is running off load it can be switched to hand on load or automatic, by switching in to one of these options the sequence steps voltage matching and synchronisation will be executed, with the result that the generator circuit breaker will be closed.

4. Operation Mode Hand Load

4.1. Hand Load Control In Stand Alone Island

Start the engine

The engine can be started with the start button in the panel door (hardware) or by the start button in HMI (software).

Control

The voltage and frequency will be controlled to the requested set-point set in the engine voltage / frequency controller. A stand alone engine has to pick up all load connected.

When the installation is running on load it can be switched to automatic, control of the installation is described in chapter 2.1.

When the installation is running on load it can be switched to hand off load, then the generator circuit breaker will be opened right away. It is not possible as a single engine to ramp down.

4.2. Hand Load Control In Multiple Engine Island

Start the engine

The engine can be started with the start button in the panel door (hardware) or by the start button in HMI (software).

Control

The voltage and frequency will be controlled to the requested set-point set in the engine voltage / frequency controller. Both real and reactive load will be shared among the running engines.

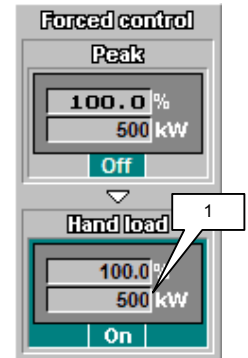
When the installation is running on load it can be switched to automatic, control of the installation is described in chapter 2.2.

When the installation is running on load it can be switched to hand off load, then the engine will start ramping down till the actual load is low enough and the generator circuit breaker will be opened.

4.3. Hand Load Control In Parallel With Utility

Start the engine

The engine can be started with the start button in the panel door (hardware) or by the start button in HMI (software). The requested load is assigned on the load control screen in the column forced control. This is a variable setting and can be modified by the operator see callout 1.



Example hand load.bmp

Control

The load and power factor will be controlled to the requested set-point set in the engine load / power factor controllers.

When the installation is running on load it can be switched to automatic, control of the installation is described in chapter 2.3.

When the installation is running on load it can be switched to hand off load, then the engine will start ramping down till the actual load is low enough and the generator circuit breaker will be opened.

5. Selected Mode Combined With A Master



In case of multiple engines in island or multiple engines parallel to the utility a master control panel will be connected to the system. With the master control panel it is also possible to start-up or stop the engines. Starting and stopping of the engines is only possible when the automatic mode is selected at the engine control panels.

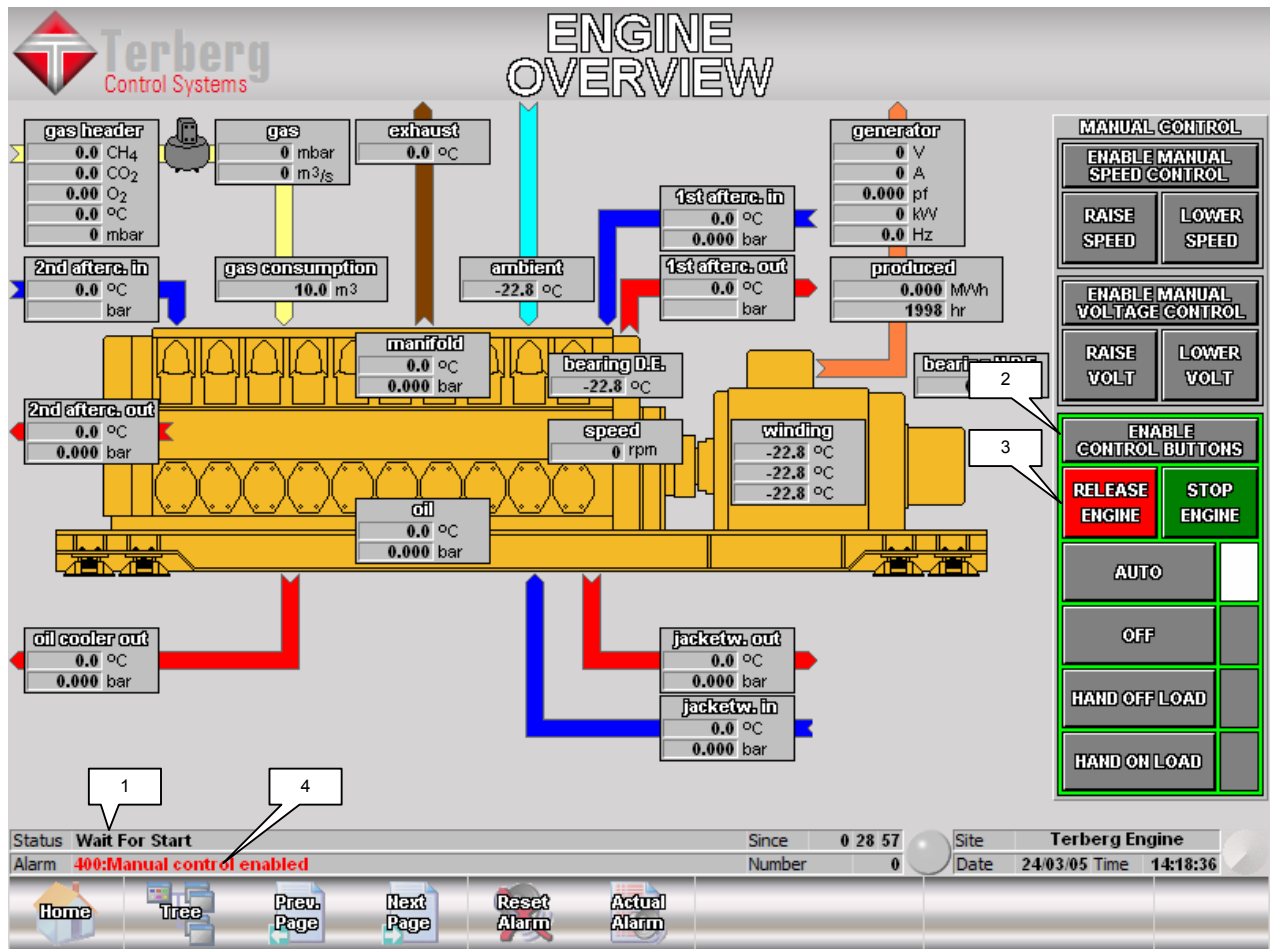
1. Engine start / stop control in manual, the engines can be started by using the start and stop buttons assigned at callouts 4 and 5.
2. Engine start / stop control in auto, the engine will start and stop automatically depending on bus bar load.
3. The space around the auto / manual button will be filled with a turquoise colour if selected.
4. Start button, to start the engine. This can only be done when the engine is in automatic mode and when the engine start / stop control in the master is on manual mode.
5. Stop button, to stop the engine. This can only be done when the engine is in automatic mode and when the engine start / stop control in the master is on manual mode.

7.1. Engine Wait For Reset



1. Installation status indication shows Engine Wait For Reset. This means that there are alarms active that may prevents the engine from starting; all active alarms have to be cleared.
2. Actual alarm with alarm tag number, this alarm can prevents the engine from starting, or is used for status storage in the historical alarm list.
3. Number of active alarms.
4. On the actual alarm list screen the active alarms are displayed with a digital, analogue or software tag number. In this example the circuit breaker is connected on digital input 1.2. This tag number can be used combined with the electrical drawings to clear / solve an alarm. Note software alarms are displayed with a general tag, SOFTW.

7.2. Wait For Start



Wait For Start.bmp

All alarms that prevent the engine from starting are cleared; the installation is ready to start.

1. Installation status indication shows Wait For Start, on pressing the release button the engine will start up.
2. Enable Control Buttons; press on this button to enable the control buttons. When the buttons are enabled the area around the control buttons will be filled with a green colour.
3. When the control buttons are enabled the engine can be started with the Release Engine button.
4. When the control buttons are enabled alarm 400:Manual control enabled will appear, this is not an alarm that prevents the engine from starting. It is a status message that can will logged in the historical alarm list.

7.3. Ventilation Engine Room (Gas Engine Only)



Ventilation Engine Room.bmp

On start up the first step is the status Ventilation Engine Room, the engine room will be ventilated to get all possible gasses or damp out of the engine room this is applicable for a gas engine, in case of a diesel engine the ventilation time is to be set to zero.

7.4. Engine Pre Lube



Engine Pre Lube.bmp

The next status is Engine Pre Lube, the oil pre lube pump will be switched on in case it is controlled by the panel auxiliaries. The running time of the oil pre lube pump is set in the pre lube pump control screen.

7.5. Engine Purge Cycle (Gas Engine Only)



Engine Purge Cycle.bmp

The next status is Engine Purge Cycle, the start relay will be energised without opening the gas valve, this to purge the left fuel gases out of the engine. This can be done with or without ignition. Purge cycle is applicable for a gas engine, in case of a diesel engine the purge cycle time can be set to zero.

7.6. Engine Start



Engine Start.bmp

The next status is Engine Start, the start motor will stay energised and the fuel valves will be opened with ignition. As soon as the crank terminate signal is detected the start motor will be de-energised.

7.7. Engine Idle -> Rated



Engine Idle -> Rated.bmp

The next status is Engine Idle Rated; the speed relay will sense crank speed. After a fixed time, rated will be energised, allowing the engine to control rated speed. The voltage and frequency are increasing.

generator	
350	V
0	A
0.000	pf
0	kW
37.4	Hz

Terberg Control Systems

Documentation

7.8. Engine Stabilisation



Engine Stabilisation.bmp

The next status is Engine Stabilisation; the engine has reached rated speed and voltage and frequency are available. Voltage and frequency will be controlled to the set point set in the engine voltage / frequency controller.

generator	
350	V
0	A
0.000	pf
0	kW
50.0	Hz

7.9. Engine Warming Up



Engine Warming Up.bmp

The next status is Engine Warming Up; the engine has reached the required voltage and frequency and will keep on running in this mode according to the set warm up time in process variables or to the jacket water temperature.

generator	
400	V
0	A
0.000	pf
0	kW
50.0	Hz

7.10. Start Up Protection



Start Up Protection.bmp

The next status is Start Up Protection; in the start up protection the installation will check if the bus bar is powered up.

Voltage on bus bar.

If the bus bar is powered up, the generator will go to voltage matching.

generator	
400	V
0	A
0.000	pf
0	kW
50.0	Hz

No voltage on bus bar.

If there is no voltage on the bus bar, the sequence will skip the voltage matching and synchronisation step. During start up protection there will be interlocking between all other (running) engines that are just going to close the circuit breaker. Due to the interlock only one engine will close the generator circuit breaker on a dead bus. All other engines will be synchronised to the bus bar to close the generator circuit breaker. After the start up protection it will step right into the off load or on load mode, depending of the key switch position.

7.10.1 Close Circuit Breaker



Close Circuit Breaker.bmp

The status Close Circuit Breaker is active when the installation is started up on a dead bus. Instead of voltage matching and synchronising the generator circuit breaker will be closed right away.

Terberg Control Systems

Documentation

7.11. Voltage Matching



Voltage Matching.bmp

The next status is Voltage Matching; the generator voltage will be controlled to the required set-point (set in the PID engine voltage control). To have a lagging power factor on closing the generator circuit breaker, the generator voltage has to be a little higher than the utility supply. This offset is set in the process variables.

During voltage matching the control panel compares the utility voltage with the produced generator voltage. The generator voltage set point will be changed in order to match the bus bar voltage.

generator	
400	V
0	A
0.000	pf
0	kW
50.0	Hz

7.12. Synchronisation



Synchronisation.bmp

The next status is Synchronisation; during the synchronisation step the synchroniser and the UVT-coil will be energised.

The synchroniser will compare the utility phase and frequency with the generator phase and frequency. If the frequency of the engine is incorrect, the synchroniser will increase or decrease the engine speed by giving the control panel pulses. When all parameters are in the predefined window, the synchroniser will give a pulse in order to close the generator circuit breaker directly. The synchroniser pulse is also provided to a digital input; on receiving the pulse a timer is started. This timer will run until the generator circuit breaker close signal is provided. If it takes too long for closing the generator circuit breaker alarm the engine will stop immediately.

Alarm 145: Generator Sync breaker operation slow.

generator	
400	V
0	A
0.000	pf
0	kW
50.0	Hz



Generator Sync Breaker Operation Slow.bmp

To reset this alarm the key switch must be switched in the off position.

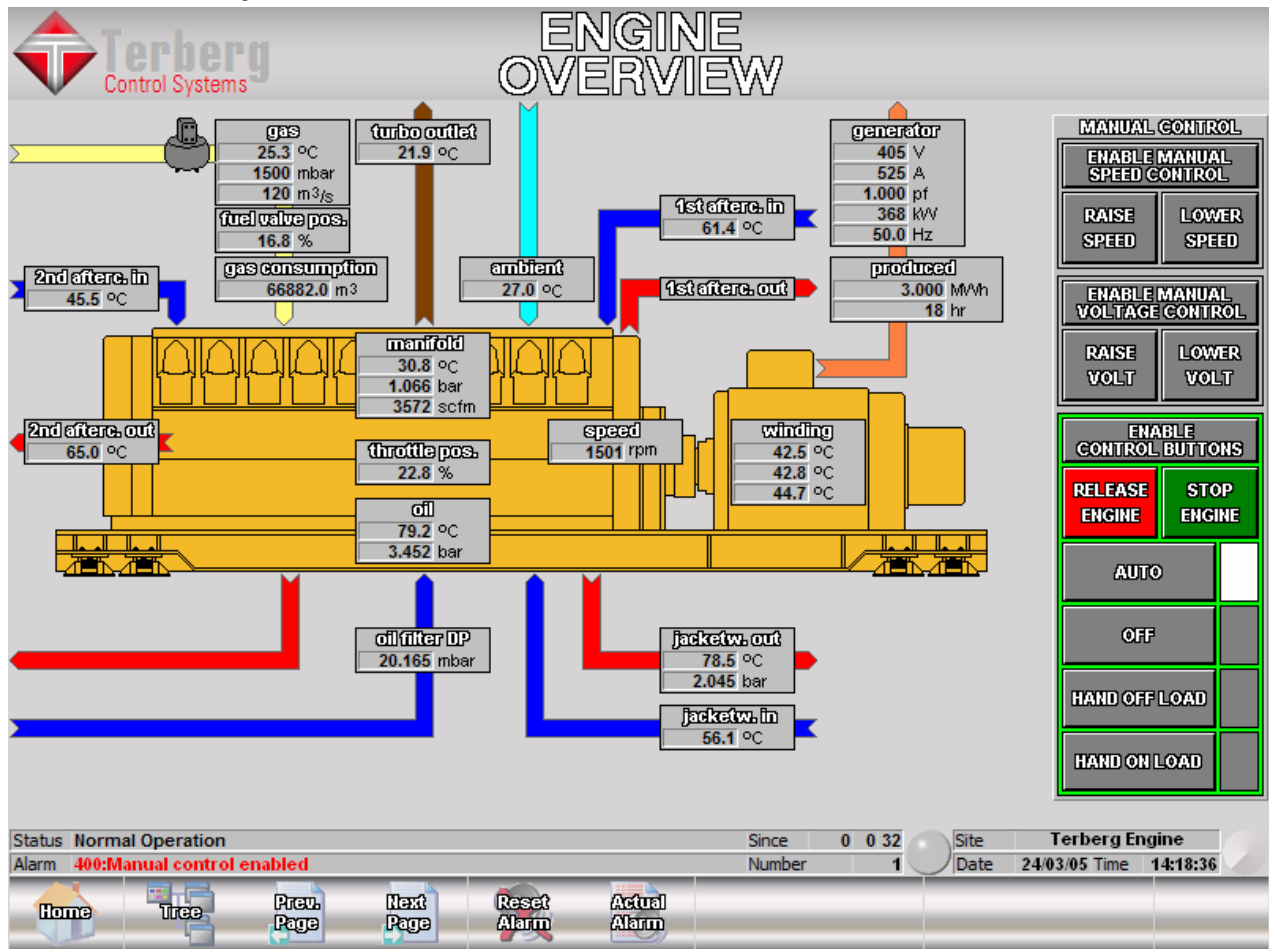
7.12.1 Engine Off Load Run



Engine Off Load Run.bmp

The status Engine Off Load Run is after synchronisation and when the key switch is in Hand Off Load mode.

7.13. Normal Operation



Normal Operation.bmp

The next status is Normal Operation; in the normal operation step the engine is controlled by power demand. The generator circuit breaker is closed to the bus bar.

7.14. Stopping the Engine

The control system is event driven. All events can be configured to stop the engine. Depending of the type of step, the sequence may be different. On a normal stop the engine will ramp down, open generator circuit breaker and cool down.

- A-Fault:** Mechanical fault, generator circuit breaker will be opened and the engine will stop directly.
- B-Fault:** Non-essential fault, engine will ramp down, open generator circuit breaker and the engine will cool down. When the engine is stopped it waits in status Engine Wait For Reset.
- D-Fault:** Electrical fault, the generator circuit breaker will be opened and the engine will cool down.
- Normal Stop:** Engine will ramp down, open generator circuit breaker and the engine will cool down. After stopping the engine is available, waiting for the next start.

	Ramp Down	Cool Down
A - Fault	0	0
B - Fault / Normal Stop (Not Used)	1	1
D - Fault	0	1

Terberg Control Systems

Documentation

Stopping of the engine can be done in several ways:

- Switch the key-switch in off position (hardware).
- Press on the stop button on the panel door (hardware).
- Press on the stop button in HMI (software).
- On load demand.
- On an occurring alarm.

All stops will be annunciated, in both actual and historical alarm list.

7.15. Engine Ramp Down



Engine Ramp Down.bmp

After normal stop, a stop on load demand or a B-fault the engine will ramp down. During ramp down the engine speed controller will receive a lower speed reference from the control panel. The speed at which the remote reference will be lowered can be set in process variables. The generator circuit breaker will be opened when the actual power is below a set percentage of the rated generator power. Default is 5.0 percent; this can be set at the load control screen.

generator	
405	V
315	A
1.000	pf
221	kW
50.0	Hz

7.16. Engine Cool Down



Engine Cool Down.bmp

The next status is Engine Cool Down; the engine will keep on running in the cool down mode as long as the set time in the process variable screen with the generator circuit breaker open.

generator	
400	V
0	A
0.000	pf
0	kW
50.0	Hz

7.17. Open Generator Circuit Breaker



Open Generator Circuit Breaker.bmp

Open Generator Circuit Breaker; the generator circuit breaker will be confirmed open before, the engine is completely stopped. In the unlikely situation that the generator circuit breaker fails to open, the engine will keep on running to prevent reverse power.

generator	
400	V
0	A
0.000	pf
0	kW
50.0	Hz

Terberg Control Systems

Documentation

7.18. Engine Stopping

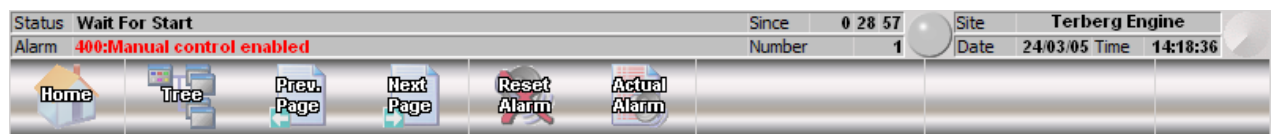


Engine Stopping.bmp

The next status is Engine Stopping; For a gas engine, during stopping the gas valve will be closed just before stopping the ignition and ECM. By doing this all remaining gas will be cleared from the engine.

generator	
350	V
0	A
0.000	pf
0	kW
37.4	Hz

7.19. Wait For Start



Wait For Start.bmp

The next status is Wait For Start; when the engine is stopped and the crank signal is lost, the control panel will go into waiting position. On load demand the engine will start up again.

generator	
0	V
0	A
0.000	pf
0	kW
0.0	Hz

7.20. Wait For Start After Failure



Wait For Start After Failure.bmp

The status Wait For Start After Failure is active when:

- The crank terminated signal is not reached within the set time in the process variables screen.
- The voltage and frequency is not stable within the set time in the process variables screen.
- The synchroniser pulse is not reached within the set time in the process variables screen.

The control panel will try to restart the engine automatically for a set amount of restarts in the process variables screen.

8. Power Factor / Voltage Control

Island

If engine(s) is (are) running in island operation, the remote volt reference to the CDVR is used to control both bus bar voltage, and kVar sharing between the running engines. Because both voltage and power factor are controlled, the bus bar voltage is independent of the total bus bar load

Parallel Grid

If an engine is running in parallel grid operation, the voltage can not, but the power factor can be controlled. Realize that the remote voltage reference to the CDVR is then used to control the generator power factor (in other words, the CDVR will not control the power factor; this is done via the control panel). If the engine is running in parallel grid operation, it will be able to cope with a voltage dip. Of course the voltage dip must be within the window of the mains protection unit, otherwise the generator circuit breaker will be opened by the protection relay. If the mains voltage will go down, without triggering the protection relay, the generator voltage will directly follow this voltage variation.

The control will not try to maintain the voltage to the original value. However, because the voltage has become lower the generator will start running lagging. In order to control the actual power factor to the required set-point, the remote voltage reference to the CDVR will be lowered. By lowering the remote volt reference, the CDVR will reduce the excitation. By lowering the excitation the engine will run less lagging and return to the set power factor, but with lower mains voltage. (On increasing mains voltage control will act vice versa to achieve the same goal: keep generator power factor constant, independent of the mains voltage)

Control philosophy

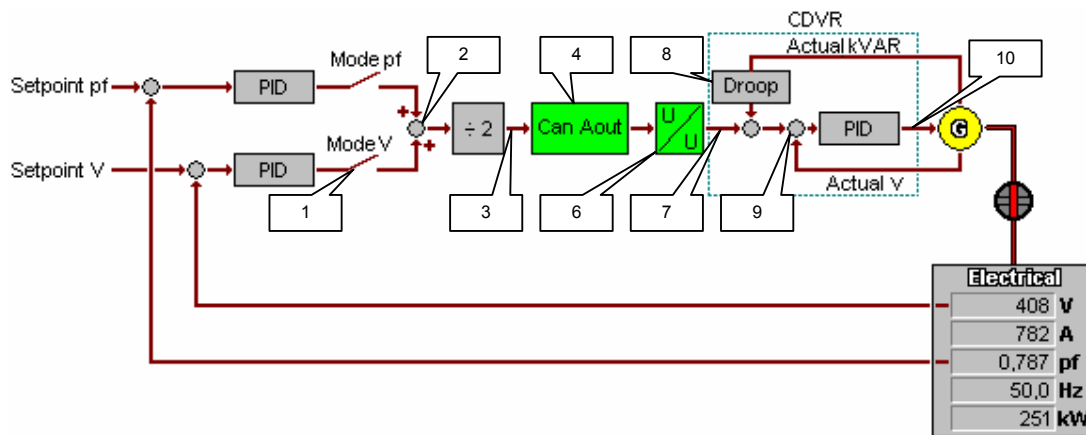
The control philosophy is described in following pages. All situations are described (parallel grid, standalone and island). Block diagrams as well as screens are combined in the description in order to give complete overview and better understanding.

Pf and Volt control are combined together in the same way as kW and Frequency are combined together. Both power factor and actual bus bar voltage are controlled by separate PID controllers. The output of both controllers is combined and used as set point for the generator volt controller (like CDVR). So power factor is not controlled by CDVR but by panel.

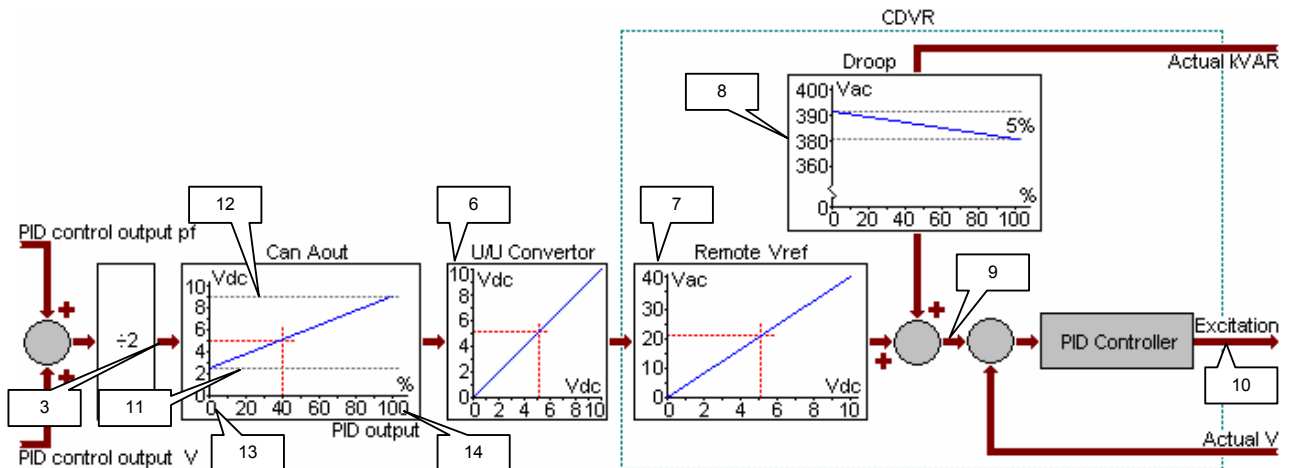
Terberg Control Systems

Documentation

1. Switch power factor and voltage control, controlled in software (see schedule voltage / power factor control).
2. Addition of the power factor and voltage controller outputs in percentage.
3. Software signal to analogue output channel (in this example AO 0.0).
4. Analogue output card to transform the software signal into a voltage signal (0..10VDC).
5. Output voltage in this example $40.0\% \times 10 \text{ volt} = 4.00 \text{ voltage output}$
6. U / U converter for galvanic isolation.
7. Remote voltage signal to CDVR.
8. Voltage droop related to measured kVARs, this is measured by CDVR using droop transformers.
9. Voltage set point.
10. Excitation to generator.
11. Minimal output boundary in percentage, in this example 25.0% (see screen for settings).
12. Maximal output boundary in percentage, in this example 90.0% (see screen for settings).
13. The minimum output range of the internal signal, in this example 0.0% (see screen for settings).
14. The maximum output range of the internal signal, in this example 100.0% (see screen for settings).



Block Diagram Voltage Control



Graphic Diagram Voltage Control

	Voltage Control (V)	Power Factor Control (pf)
Stand Alone (Single Engine)	Control to set point (mode V = 1)	Set point = actual pf (mode pf = 1)
Island (Multiple Engine)	Control to set point (mode V = 1)	Share kVAR (mode pf = 1)
Parallel With Utility	Disabled (mode V = 0)	Control to set point (mode pf = 1)
Hand Off Load	Control to set point (mode V = 1)	Disabled (mode pf = 0)

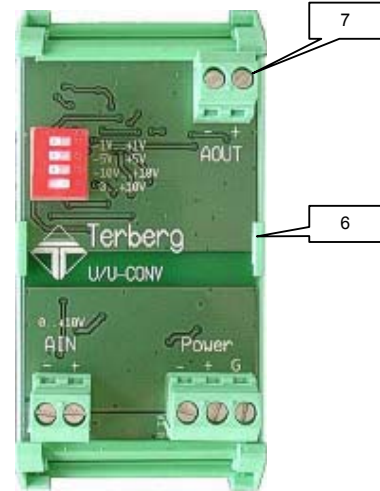
Terberg Control Systems

Documentation

Schedule voltage / power factor Control



CAN-A-Out



U-U Converter



EXTENDED SETTINGS ANALOGUE OUTPUTS

number couple		output value	OUTPUT TYPE			OUTPUT FORGING			DESCRIPTION			
number	couple	output value	min	boundary	max	force	lower value	raise	min	max	actual	
AO 00.0	121	40.0 %	0 - 100%						Signal to generat voltage control	min: 0.0	max: 100.0	actual: 51.0 %
AO 00.1	122	%	25.0 %	90.0 %					Signal to speed c	min: 13	max: 14	actual: 3 %
AO 00.2	108	43.3 %	20 - 100%						Generator Load	min: 0.0	max: 129.0	actual: 1166 kW
AO 00.3	0	0.0 %	20 - 100%							min: 0.0	max: 0.0	actual: 0.0

number couple amount

NC 0 0

rescan all inputs

one (or more) inputs double config.

INPUT DOUBLE CONFIGURED

last found card

AO 00.x ad 0

update selection

auto update

card configuration is changed

Status Normal Operation

Alarm

Since 0 0 32

Number 0

Site Terberg Engine

Date 24/03/05 Time 14:18:36

Home

Tree

Prev. Page

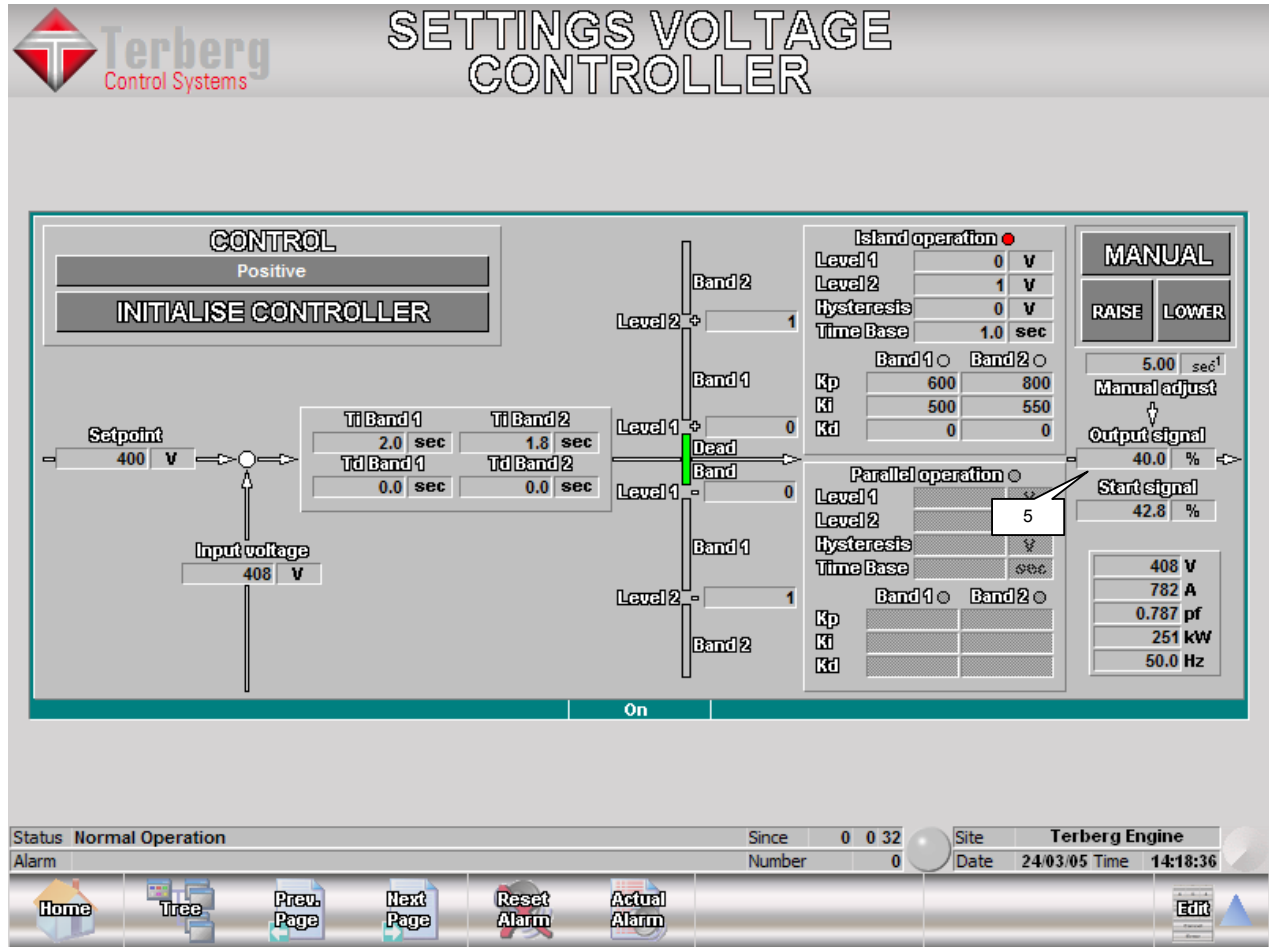
Next Page

Reset Alarm

Actual Alarm

Anaout_2.bmp

Terberg Control Systems
Documentation



Pid3_vlt.bmp

9. Frequency / Load Control

Island operation

If engines are running in island but synchronised together, both frequency and kW are controlled. Because of this control set-up, the bus bar frequency is independent of the load. (So although speed droop is set-up engines will behave like running in isochronous) No load share module is required, because panel will read actual produced electrical power, and will use this measurement to change speed set point to control to the required load.

Parallel grid operation

In parallel grid operation, the frequency will not be controlled. Only the engine power will be controlled.

If a small frequency variation occurs in the utility, the generator will not try to maintain 50Hz (because it is simply not possible to change the grid frequency). If the engine would try to do so, the engine will go in overload.

Due to the frequency drop, the generator load will increase. The system will try to maintain the requested power set-point, so when mains frequency is lowered the remote speed reference will be lowered. On reading a lower speed reference on the GECM, the throttle will be moved to the closed position. On closing the throttle, the engine load will be reduced, and the generator will continue to run on the requested kW set point, but with a lower mains frequency. (On increasing grid frequency kW control will work vice versa to achieve the same goal: Keep generator power constant, independent of mains frequency).

Control philosophy

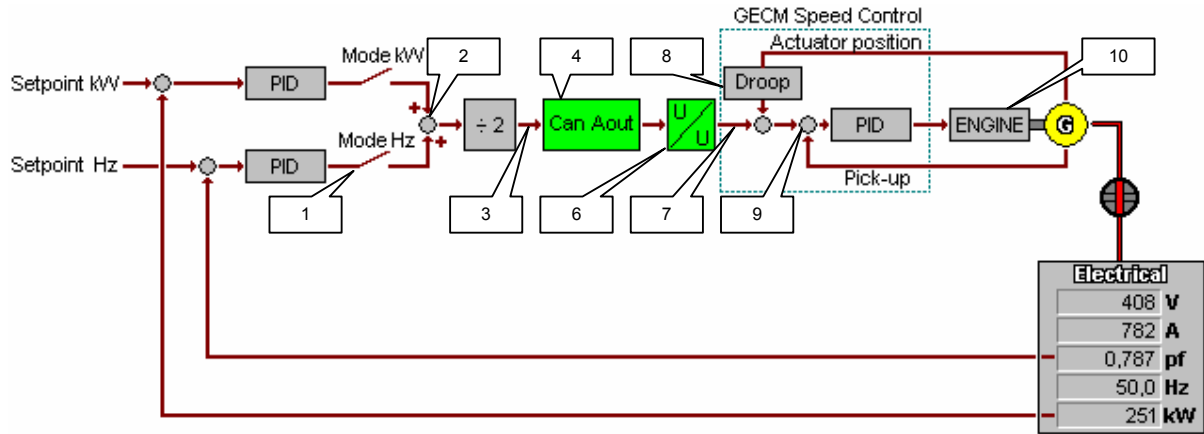
The control philosophy is described in following pages. All situations are described (parallel grid, standalone and island). Block diagrams as well as screens are combined in the description in order to give complete overview and better understanding.

Pf and Volt control are combined together in the same way as kW and Frequency are combined together. Both engine actual power and actual generator frequency are controlled by separate PID controllers. The output of both controllers is combined and used as set point for the generator speed controller (like GECM). So the actual engine load is not controlled by GECM, but by panel.

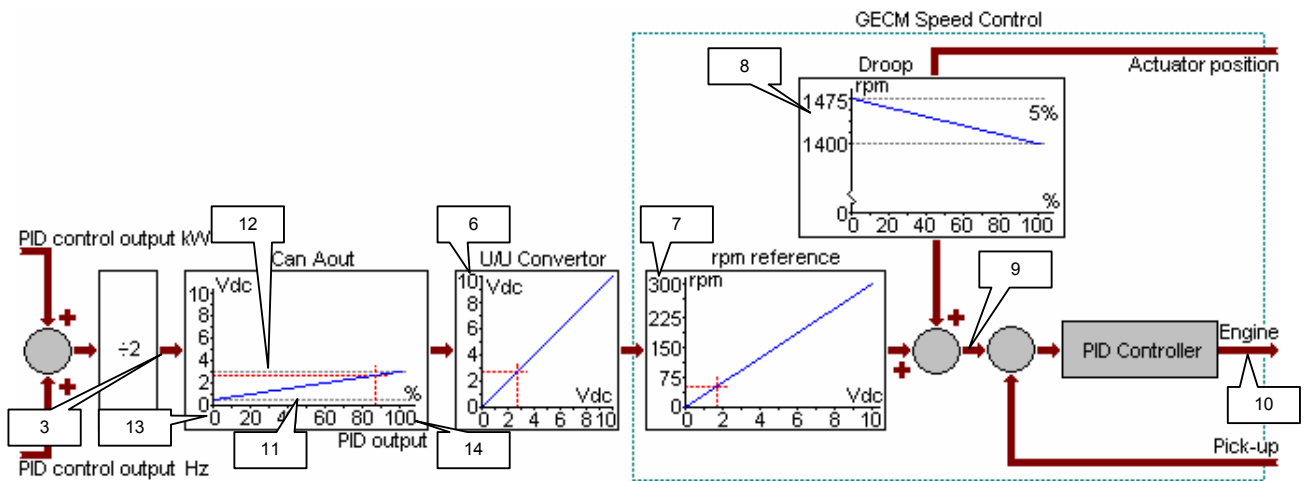
1. Switch frequency and load control, controlled in software (see schedule frequency / load control).
2. Addition frequency and load controller outputs in percentage.
3. Software signal to analogue output channel (AO 0.1).
4. Analogue output card to transform the software signal into milliamp or voltage signal.
5. Output voltage in this example $86.6\% \times 10 \text{ volt} = 8.66 \text{ voltage output}$
6. U / U converter for galvanic isolation.
7. Remote speed reference to engine speed control.
8. Speed droop related to engine power.
9. Speed set point.
10. Throttle control.
11. Minimal output boundary in percentage, in this example 5.0%.
12. Maximal output boundary in percentage, in this example 30.0%.
13. The minimum output range of the internal signal, in this example 0.0%.
14. The maximum output range of the internal signal, in this example 100.0%.

Terberg Control Systems

Documentation



Block Diagram Speed Control



Signal Conversion Speed Control

	Frequency Control (Hz)	Load Control (kW)
Stand Alone (Single Engine)	Control to set point (mode Hz = 1)	Set point = actual load (mode kW = 1)
Island (Multiple Engine)	Control to set point (mode Hz = 1)	Share total load (mode kW = 1)
Parallel With Utility	Disabled (mode Hz = 0)	Control to set point (mode kW = 1)
Hand Off Load	Control to set point (mode Hz = 1)	Disabled (mode kW = 0)

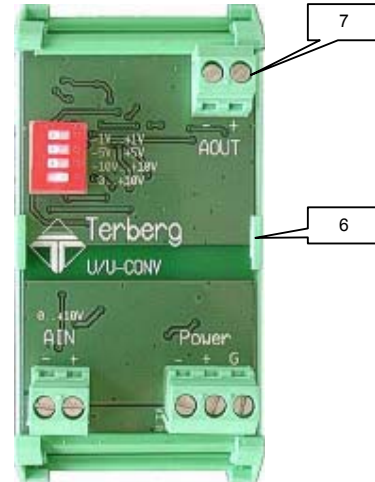
Schedule Hz/kW Control

Terberg Control Systems

Documentation



CAN-A-Out



U-U Converter



EXTENDED SETTINGS ANALOGUE OUTPUTS

number couple		output value	OUTPUT TYPE			OUTPUT FORGING			DESCRIPTION
number	couple		min	boundary	max	force	lower value	raise	
AO 00.0	121	51.0 %	0 - 100%						Signal to generate voltage control
			25.0 %		90.0 %				min: 0.0 max: 100.0 actual: 51.0 %
AO 00.1	122	86.6 %	0 - 100%						Signal to engine speed control
			5.0 %		30.0 %				min: 0.0 max: 100.0 actual: 86.6 %
AO 00.2	108	3 %	0 - 100%						Generator load
			20 - 100%						min: 13 max: 14 actual: 3 kW
AO 00.3	0	0.0 %	20 - 100%						
			0.0 %		0.0 %				min: 0.0 max: 0.0 actual: 0.0

number couple amount

NC 0 0

rescan all inputs

one (or more) inputs double config.

INPUT DOUBLE CONFIGURED

last found card

AO 00.x ad 0

update selection

auto update

card configuration is changed

Status Normal Operation

Alarm

Since 0 0 32

Number 0

Site Terberg Engine

Date 24/03/05 Time 14:18:36

Home

Tree

Prev. Page

Next Page

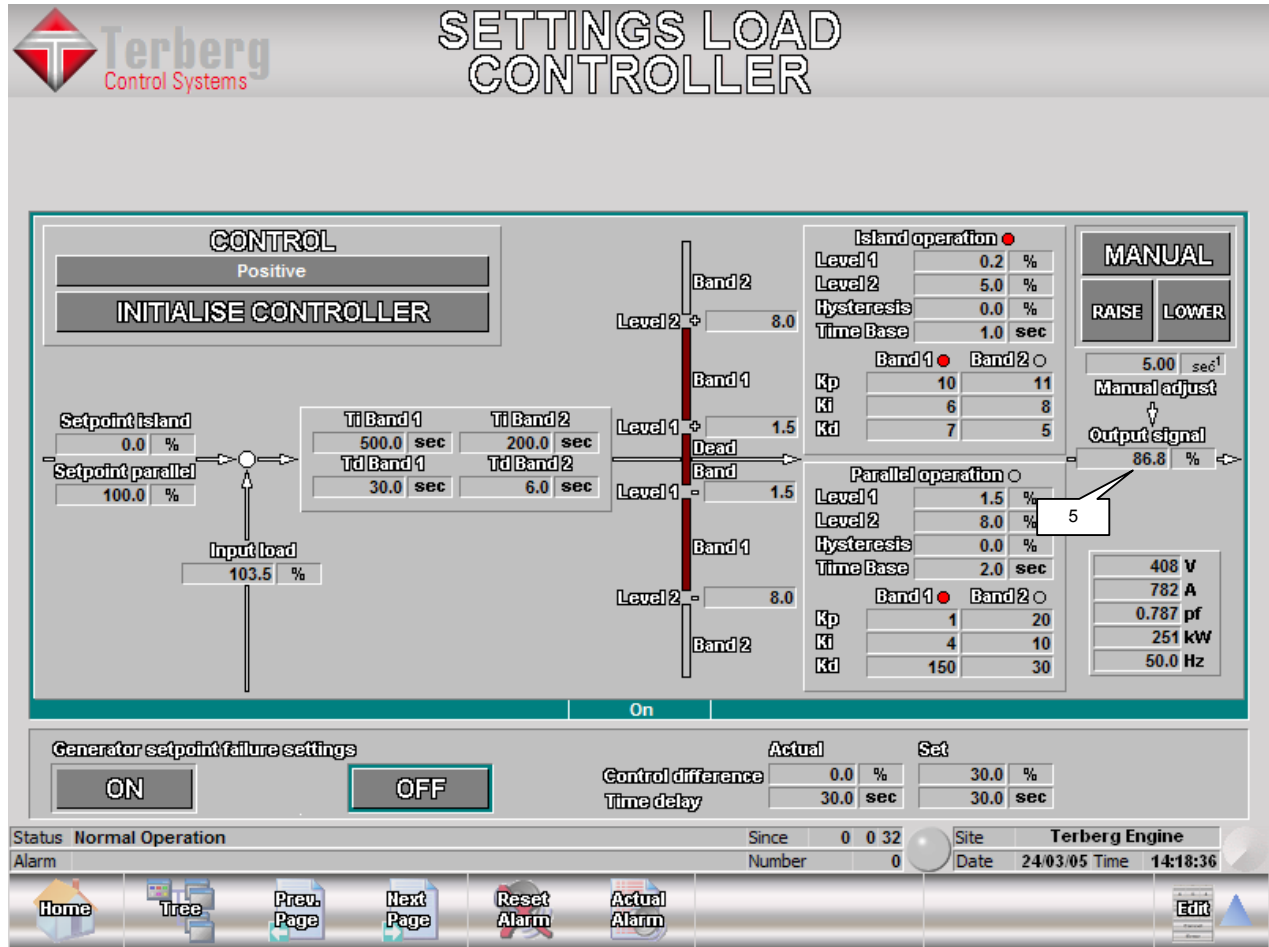
Reset Alarm

Actual Alarm

Edit

Anaout_2.bmp

Terberg Control Systems
Documentation



Pid3_kw.bmp

10. Fault Analysis

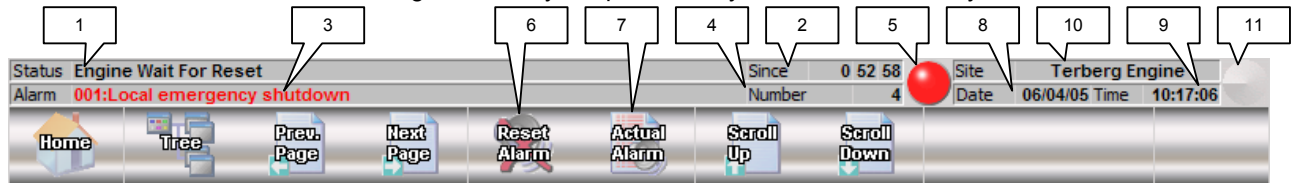
10.1. General Alarm Indication

The main purpose is trying to find out how to clear an alarm. The documentation is based on examples and will give a quick guideline.

In the HMI each screen, displays the actual engine status and possible alarm(s) / events.

On the actual alarm screen each alarm has an indication for the alarm source; this makes it easier to trace alarms in the electrical drawings:

- Ixx.x, alarm is triggered by a digital input.
- Alx.x, alarm is triggered by an analogue input.
- SOFTW, the alarm is not (directly) related to hardware.
- PA, CCM, PYRO etc, alarm generated by the power analyser, CCM module, Pyrometer etcetera.



General Alarm Indication.bmp

1. Actual installation status indication.
2. The elapsed time in actual status, presentation in hh:mm:ss (hours: minutes: seconds). When the installation switches over to a new status for example "Wait For Start", this counter will be reset to zero.
3. The latest actual alarm or event that has occurred.
4. The actual number of alarms or events that are active.
5. This is an alarm status indication "LED", this "LED" can have 3 different statuses.
 - Grey coloured, there are no alarms / events active.
 - Red coloured flashing, a new alarm / event has occurred.
 - Red coloured steady, on a new alarm / event the operator has reset the alarm but the alarm isn't cleared from the actual alarm list. So the alarm is still active.
6. Button to reset alarms / events, level 1 is the minimal permitted level to reset alarms.
7. Button for accessing the actual alarm list screen.
8. Actual date, presentation in dd/mm/yy (day/month/year).
9. Actual time, presentation in hh:mm:ss (hours: minutes: seconds).
10. Site or project name.
11. Communication indication, this indication shows if there is a stabile connection between PC / IPC and the SBC. When the indicator is running continuously, the communication is active and healthy. If the indicator is running but hitching, then the communication couldn't be established.

This chapter is about how to solve an alarm that is triggered by a digital input. A combination of using the electrical drawings and the HMI will make it possible for an operator to solve an active alarm.



A_a_list Digital Input.bmp

On an alarm view the actual alarm list

On the actual alarm list screen all active alarms can be monitored, in this case we use alarm *001:Local emergency shutdown* as example.

1. Latest alarm that occurred: *001:Local emergency shutdown.*
2. The alarm is listed in the actual alarm list.
3. This is the source of the digital input. The local emergency shutdown is configured at DI 00.2. This reference to a digital input card 0 (zero), input number 2.

Terberg Control Systems

Documentation

INPUT FORGING					
number	couple	inverse	non	to 1	to 0
DI 00.1	95				
DI 00.2	115				
DI 00.3	0				
DI 00.4	234				
DI 00.5	4				
DI 00.6	2				
DI 00.7	8				
DI 01.0	0				
DI 01.1	0				
DI 01.2	0				
DI 01.3	0				
DI 01.4	0				
DI 01.5	0				
DI 01.6	0				
DI 01.7	0				

DESCRIPTION
☒ Key Switch To " Auto "
☐ Key Switch To " Hand "
☐ ESPB Emergency Shutdown Local
☐
☒ CAT Alarm
☒ Circuit Breaker Mains Measuring
☒ Circuit Breaker Generator Measuring
☒ Charger Control Batteries Failed
☐
☐
☐
☐
☐
☐
☐
☐
☐
☐

number couple amount rescan all inputs one (or more) inputs double config.

SOFTW 0 0

INPUT DOUBLE CONFIGURED

number couple amount reset all forced inputs one (or more) inputs are forced

SOFTW 0 0

FORCED INPUTS

Status Engine Wait For Reset

Alarm 001:Local emergency shutdown

Since 0 52 58

Number 4

Site Terberg Engine

Date 06/04/05 Time 10:17:06

Home
Tree
Prev. Page
Next Page
Reset Alarm
Actual Alarm
Scroll Up
Scroll Down

Digital Inputs.bmp

Check the digital input (software)

1. The real physical status indication of the digital input. Green = 1 & White = 0.
2. Address of the digital input.
3. Terberg tag number, this tag number is assigned to digital input l_emergency_shutdown_local.
4. Indication of the digital input as used in the software after possible conversions, see point 6 until 9. Green = 1 & White = 0.
5. Description of the digital input signal.
6. Inverse button to inverse the logic if the input is inverted the button change color (grey into turquoise) see input number DI 00.4
- 7/9 Input forcing: Forcing an input means: in spite of the actual status of the input number, the software will read the forced situation. Depending of the actual status of the input signal one can force to 1 (8) or 0 (9) the forcing can be reset by pushing button "non" (7). If the forcing is undone the software will go back reading actual status. If force to 1 or 0 is selected these buttons will be colored red.

As shown in the above example the digital input 0.2 is not high / active, see callout 1. The functions from callouts 6 until 9 are not used, there is no software interference. This means that there is no physical voltage signal provided on the input. This information leads us to the hardware; therefore we have to look at the electrical drawing.

Terberg Control Systems Documentation

Page - index					
Section	Page	Page header	Section	Page	Page header
E1.CTRL 1	1	Title page	E1.CTRL 36	36	Engine starting
E1.CTRL 2	2	Index	E1.CTRL 39	39	IPC
E1.CTRL 3	3	Index	E1.CTRL 100	100	CAN Network structure
E1.CTRL 4	4	Revisions	E1.CTRL 101	101	SBC 7-2 Controller Module
E1.CTRL 10	10	Reference	E1.CTRL 102	102	SBC 7-2 DIN I 0.0 - 0.7
E1.CTRL 11	11	Earthing	E1.CTRL 103	103	SBC 7-2 DIN I 1.0 - 1.7
E1.CTRL 17	17	Overview used panels	E1.CTRL 104	104	SBC 7-2 DIN I 2.0 - 2.7
E1.CTRL 18	18	Cabinet front view	E1.CTRL 105	105	SBC 7-2 DIN I 3.0 - 3.7
E1.CTRL 19	19	Wiringnumbers	E1.CTRL 106	106	SBC 7-2 DIN I 4.0 - 4.7
E1.CTRL 20	20	Supply voltage	E1.CTRL 107	107	SBC 7-2 DIN I 5.0 - 5.7
E1.CTRL 21	21	Battery charger	E1.CTRL 108	108	SBC 7-2 DREL 0 0.0 - 0.7
E1.CTRL 22	22	Ventilation/panel light	E1.CTRL 109	109	SBC 7-2 DREL 0 1.0 - 1.7
E1.CTRL 23	23	Spare	E1.CTRL 110	110	SBC 7-2 DOUT 0 2.0 - 2.7
E1.CTRL 24	24	Customer interface module	E1.CTRL 111	111	SBC 7-2 DOUT 0 3.0 - 3.7
E1.CTRL 25	25	Emergency stop engine	E1.CTRL 112	112	SBC 7-2 AIN AI 0.0 - 0.7
E1.CTRL 26	26	Power analyser + Loadsharing unit	E1.CTRL 114	114	SBC 7-2 ROUT AO 0.0 - 0.3
E1.CTRL 27	27	Spare	E1.CTRL 115	115	CAN-COM
E1.CTRL 28	28	U/U-converter	E1.CTRL 117	117	Supplement alarm handling
E1.CTRL 29	29	Spare	E1.CTRL 118	118	U/U-converter
E1.CTRL 30	30	Gas Engine Control Module	E1.CTRL 119	119	U/U-converter
E1.CTRL 31	31	Gas Engine Control Module	E1.CTRL 120	120	U/U-converter
E1.CTRL 32	32	Synchronising system	E1.CTRL 121	121	U/U-converter
E1.CTRL 33	33	Synchronising Breaker Control	E1.CTRL 122	122	U/U-converter
E1.CTRL 34	34	DVR Engine	E1.CTRL 123	123	U/U-converter
E1.CTRL 35	35	gas meter pulse - engine protections	E1.CTRL 124	124	xi: Terminal strip

page header : Index	GRP =
drawing : Terberg Engine	page's 181
	page : 2

 Terberg Control Systems 22000000 (The Netherlands) Tel: +31 (0) 38 68 69 513 Fax: +31 (0) 38 68 78 517	drawing : design : instruction: version: 83.0 plot-date : date :	Default Demo Project Synchronising panel	page header : Index GRP = drawing : Terberg Engine page's 181 page : 2
--	---	---	--

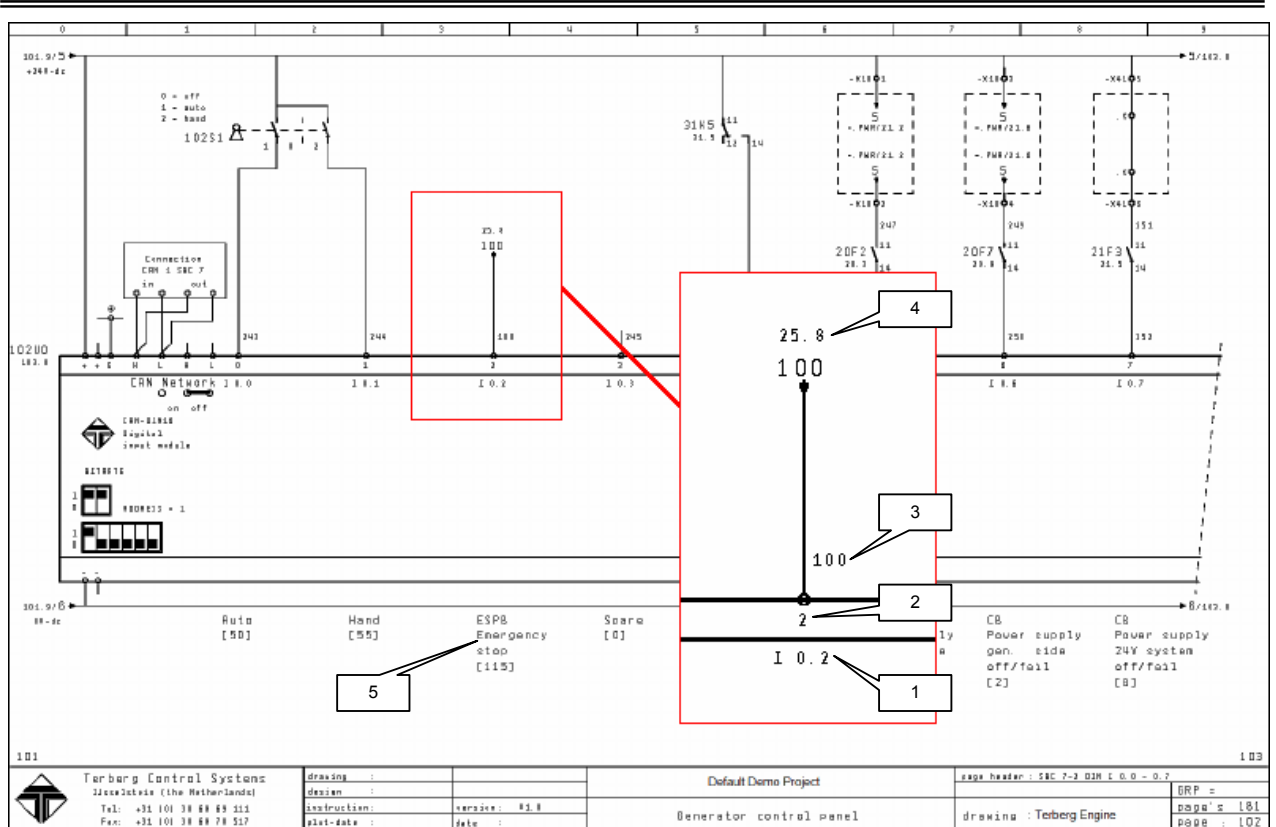
Page Index.bmp

Check the digital input (hardware)

Find the relevant page of the digital input in the electrical drawing.

1. The digital input that has been searched is 0.2. This input is located in the range from I0.0 till 0.7.
2. The relevant page number where related input is located is in this example page 102.
3. Actual page number of the electrical drawing.
4. Last page number of this drawing.
5. Page number of the first page after this page. This number is added because sometimes page numbers deliberately are omitted. Because next page number is indicated one does know that no page is missing

Terberg Control Systems Documentation

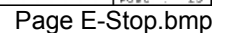


Page Input.bmp

On this page the hardware connection to digital input 0.0 till 0.7 is shown.

1. The digital input reference (input I 0.2). Realize that in the text screen displayed in HMI a leading zero is added in front of the input number.
2. Input number which is indicated on the CAN digital input card. On each card the inputs are numbered from 0 till 15.
3. Wire number, each electrical node does have an unique number. This future is easy in order to investigate the panel wiring.
4. In this example the wire connected to this input is continuing to another page, the page is indicated as 25.8 which means page 25 column 8.
5. Description of the digital input signal with the Terberg tag number.

The signal to this digital input is provided by a device / component on another page, therefore we have to look at page 25.



1. Column to which the reference at the previous screen was referring (25.8).
2. Page where this wire continues (referring back to 102.3 which is page 102 column 3).
3. Relays are labeled directly related to the page number where they are drawn. This relay 25K8 is defined at page 25, column 8.
4. The relay 25K8 is a double pole relay. All contacts are drawn beneath the relay; this is a reference to other pages where the contacts of this relay are used. In this example one contact has number 31.4, the contact will be on page 31 column 4.
5. This is an emergency stop button mounted in the panel door; if the emergency button is pushed in, the relay 25K8 will never be energized.
6. This is a wire bridge connected between terminal X30 3 and 4; this wire bridge can be used to connect an external emergency stop in serial to the additional emergency stop circuit.

- The relay 25K8 is de-energized by controlling the emergency stop button.
- Relay 25K8 is defect.
- The wire bridge or external emergency stop between terminal X30 3 and 4 is not connected.
- The wire number 100 is not properly fitted on the digital input card.
- The input on the digital input card is defect.

A_a_list Analogue Input.bmp

1. The alarm is listed in the actual alarm list.
2. This is the source of the analogue input. The generator winding temperature L1 is configured at AI 00.2. This reference to an analogue input card 0 (zero), input number 2.

Terberg Control Systems Documentation

number	couple	input value	ERROR min max	INPUT FORGING force lower value raise	DESCRIPTION
AI 00.0	17	70 mb 0.0 %	☐ error ☐	☐ ☐ 0 ☐	Gas Pressure
AI 00.2	19	1467 °C 0.0 %	☐ error ☐	☐ ☐ 0 ☐	Stator Winding Temperature L1
AI 00.3	20	974 °C 0.0 %	☐ error ☐	☐ ☐ 0 ☐	Stator Winding Temperature L2
AI 00.4	21	886 °C 0.0 %	☐ error ☐	☐ ☐ 0 ☐	Stator Winding Temperature L3
AI 00.5	0	0 0.0 %	☐ error ☐	☐ ☐ 0 ☐	
AI 00.6	0	0 0.0 %	☐ error ☐	☐ ☐ 0 ☐	
AI 00.7	0	0 0.0 %	☐ error ☐	☐ ☐ 0 ☐	

number	couple	amount	rescan all inputs	one (or more) inputs double config.	INPUT DOUBLE CONFIGURED
NC	0	0	☐	☐	

number	couple	amount	reset all forced inputs	one (or more) inputs are forced	FORCED INPUTS
NC	0	0	☐	☐	

Status Engine Wait For Reset Since 6 41 40 Site Terberg Engine
 Alarm 255:ID 19 Gen winding temp L1 high - pre ala Number 14 Date 06/04/05 Time 16:05:52

Home Tree Prev. Page Next Page Reset Alarm Actual Alarm Scroll Up Scroll Down Edit

Analogue Inputs.bmp

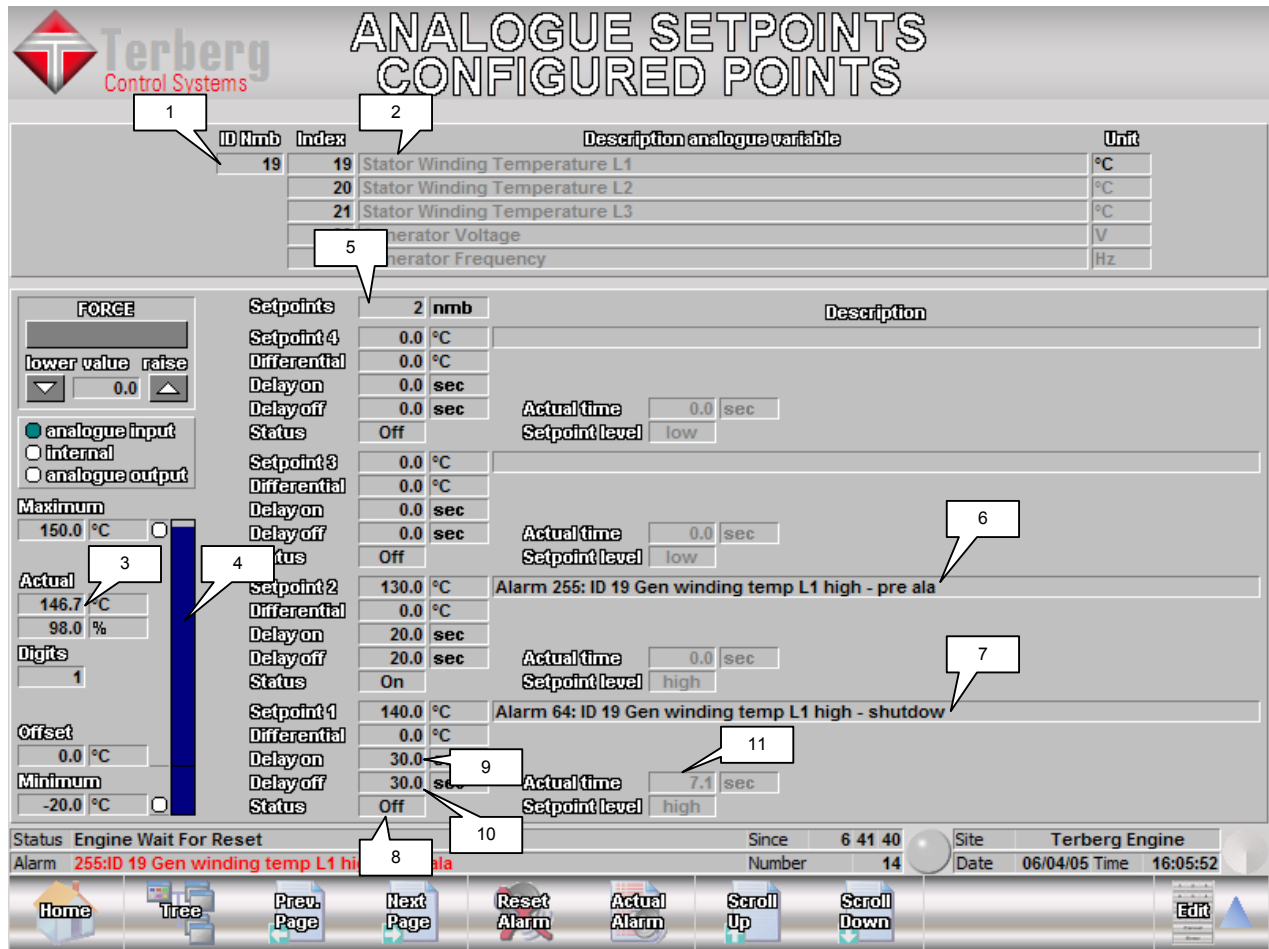
Check the analogue input (software)

1. Address of the analogue input.
2. Terberg tag number, this tag number is assigned to analogue input AI_stator_winding_temp_L1.
3. Indication of the measured value.
4. Description of the analogue input signal.

As shown in the above example the measured temperature at analogue input 0.2 high. AI do this screen doesn't provide any information about what activated the alarm.

Terberg Control Systems

Documentation



Analogue Set Points.bmp

Alarms on analogue inputs will be activated by the set points. If a measured value from an analogue input reaches above or beneath a certain set point an alarm will be activated.

1. Terberg tag number.
2. Description of the analogue input signal.
3. Indication of the measured value.
4. Indication of the measured value displayed in a bar.
5. Number of configured set points.
6. Alarm 255 will be activated when the temperature is higher then 130 degrees.
7. Alarm 64 will be activated when the temperature is higher then 140 degrees.
8. Output status indication.
9. Delay when the output is switched to the "on" status.
10. Delay when the output is switched to the "off" status.
11. Actual time of the time delay, counting from the set time till zero.

Actual alarm is set because actual measured temperature is higher then the set point at set point 2 (see callout 6). Even while the actual measured temperature is higher then the set, set point at set point 1 (see callout 7), this alarm isn't activated yet. This alarm will be activated when the delay on time (see callout 9 and 11) is counted down till zero.

Terberg Control Systems Documentation

Page - index					
Section	Page	Page header	Section	Page	Page header
E1.CTRL 1	1	Title page	E1.CTRL 36	36	Engine starting
E1.CTRL 2	2	Index	E1.CTRL 39	39	IPC
E1.CTRL 3	3	Index	E1.CTRL 100	100	CAN Network structure
E1.CTRL 4	4	Revisions	E1.CTRL 101	101	SBC 7-2 Controller Module
E1.CTRL 10	10	Reference	E1.CTRL 102	102	SBC 7-2 DIN I 0.0 - 0.7
E1.CTRL 11	11	Earthing	E1.CTRL 103	103	SBC 7-2 DIN I 1.0 - 1.7
E1.CTRL 17	17	Overview used panels	E1.CTRL 104	104	SBC 7-2 DIN I 2.0 - 2.7
E1.CTRL 18	18	Cabinet front view	E1.CTRL 105	105	SBC 7-2 DIN I 3.0 - 3.7
E1.CTRL 19	19	Wiringnumbers	E1.CTRL 106	106	SBC 7-2 DIN I 4.0 - 4.7
E1.CTRL 20	20	Supply voltage	E1.CTRL 107	107	SBC 7-2 DIN I 5.0 - 5.7
E1.CTRL 21	21	Battery charger	E1.CTRL 108	108	SBC 7-2 DREL 0 0.0 - 0.7
E1.CTRL 22	22	Ventilation/panel light	E1.CTRL 109	109	SBC 7-2 DREL 0 1.0 - 1.7
E1.CTRL 23	23	Spare	E1.CTRL 110	110	SBC 7-2 DOUT 0 2.0 - 2.7
E1.CTRL 24	24	Customer interface module	E1.CTRL 111	111	SBC 7-2 DOUT 0 3.0 - 3.7
E1.CTRL 25	25	Emergency stop engine	E1.CTRL 112	112	SBC 7-2 AIN AI 0.0 - 0.7
E1.CTRL 26	26	Power analyser + Loadsharing unit	E1.CTRL 114	114	SBC 7-2 ROUT AO 0.0 - 0.3
E1.CTRL 27	27	Spare	E1.CTRL 115	115	CAN-COM
E1.CTRL 28	28	U/U-converter	E1.CTRL 117	117	Supplement alarm handling
E1.CTRL 29	29	Spare	E1.CTRL 118	118	U/U-converter
E1.CTRL 30	30	Gas Engine Control Module	E1.CTRL 119	119	U/U-converter
E1.CTRL 31	31	Gas Engine Control Module	E1.CTRL 120	120	U/U-converter
E1.CTRL 32	32	Synchronising system	E1.CTRL 121	121	U/U-converter
E1.CTRL 33	33	Synchronising Breaker Control	E1.CTRL 122	122	U/U-converter
E1.CTRL 34	34	DVR Engine	E1.CTRL 123	123	U/U-converter
E1.CTRL 35	35	gas meter pulse - engine protections	E1.CTRL 124	124	xi: Terminal strip

page header : Index	GRP =
drawing : Terberg Engine	page's 181
	page : 2

Terberg Control Systems 22000000 (The Netherlands) Tel: +31 (0) 38 68 69 513 Fax: +31 (0) 38 68 78 517	drawing : design : instruction : plot-date :	version : 83.0 date :	Default Demo Project Synchronising panel	page header : Index GRP = page's 181 page : 2
---	---	--------------------------	---	--

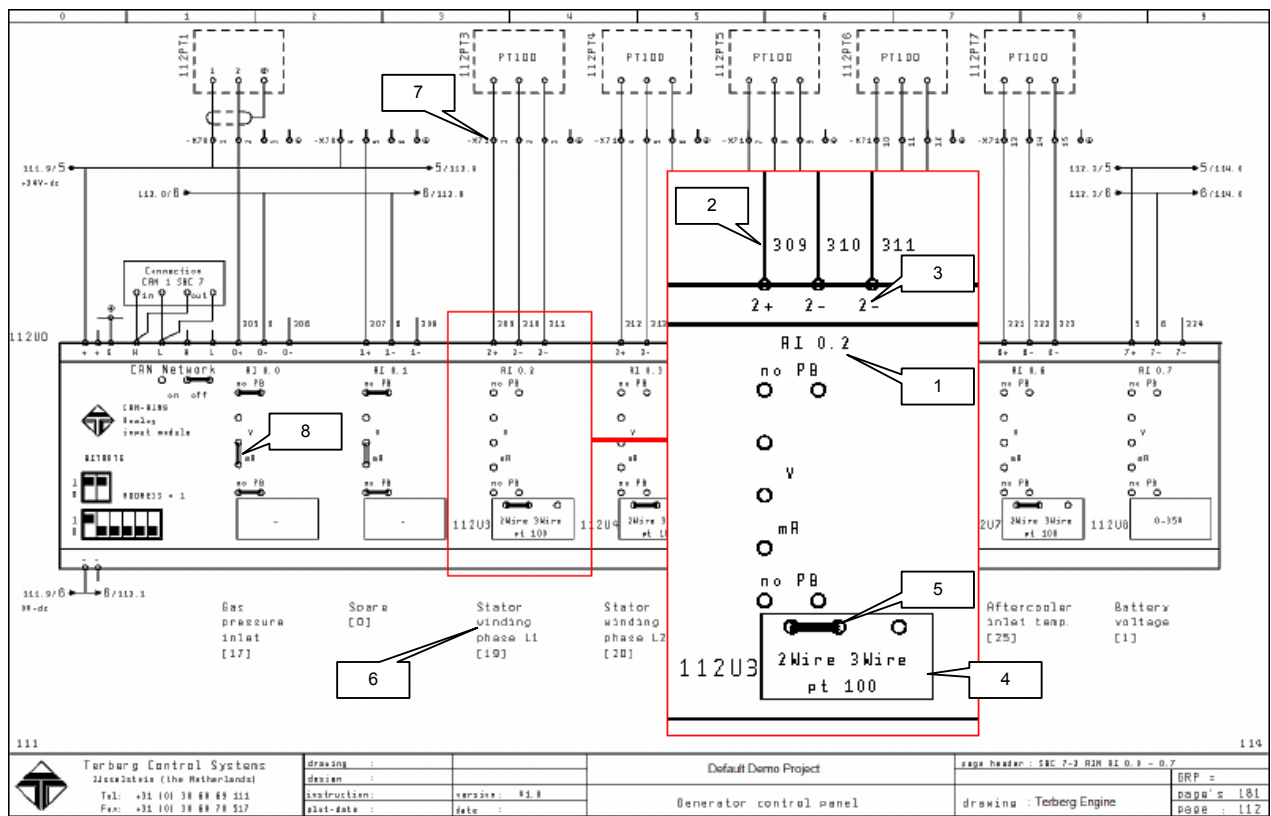
Page Index.bmp

Check the analogue input (hardware)

Find the relevant page of the analogue input in the electrical drawing.

1. The analogue input that has been searched is 0.2. This input is located in the range from AI 0.0 till 0.7.
2. The relevant page number where related input is located is in this example page 112.
3. Actual page number of the electrical drawing.
4. Last page number of this drawing.
5. Page number of the first page after this page. This number is added because sometimes page numbers deliberately are omitted. Because next page number is indicated one does know that no page is missing

Terberg Control Systems Documentation

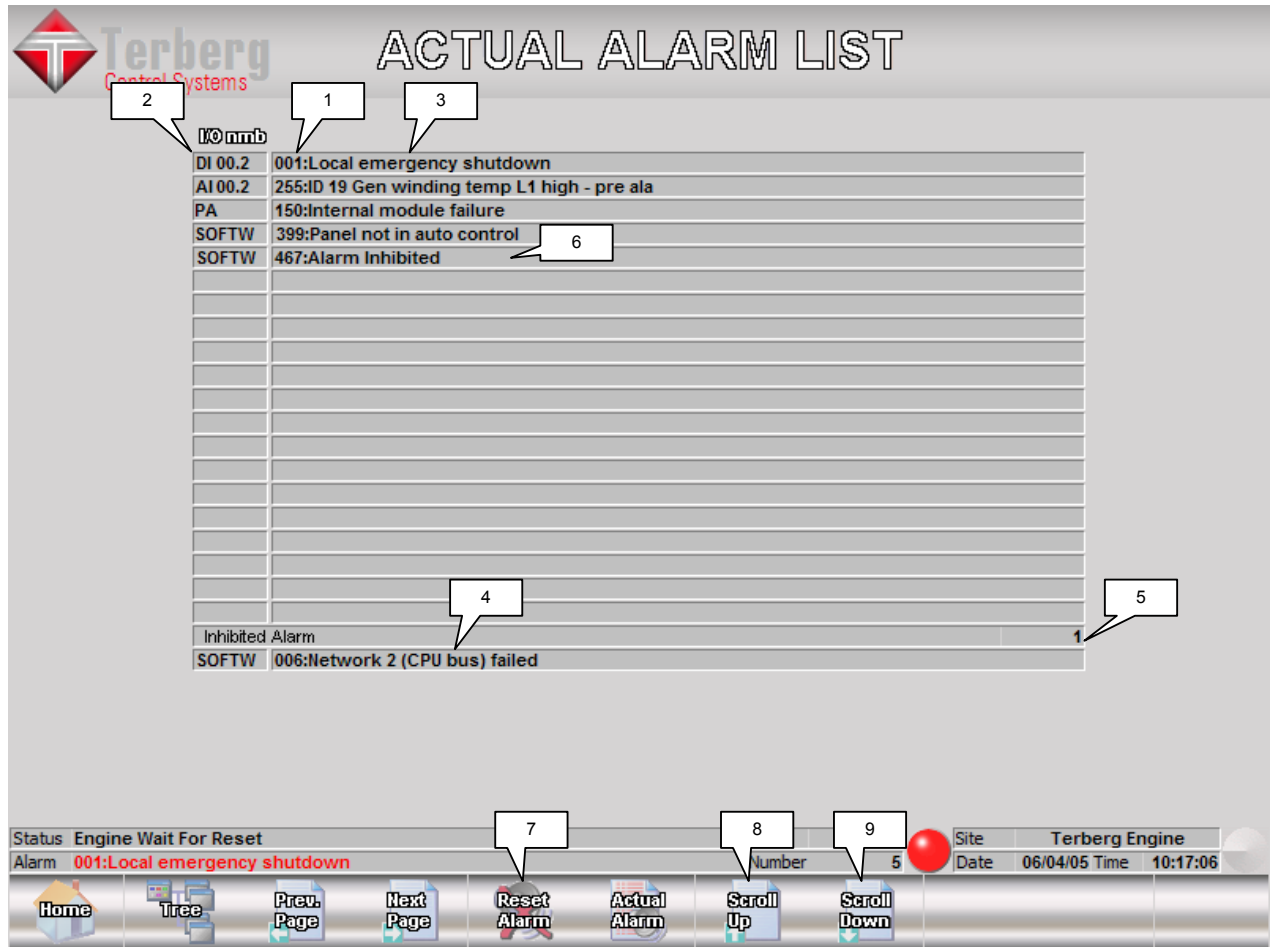


Page Analogue Input.bmp

On this page the hardware connection to analogue input 0.0 till 0.7 is shown.

1. The analogue input reference (input AI 0.2), which is indicated on the CAN digital input card.
2. Wire numbers, each electrical node does have an unique number. This future is easy in order to investigate the panel wiring.
3. Terminals on the CAN analogue input card.
4. Depending of the connected analogue input signal, a piggy bag has to be mounted on the analogue input card. The different types of piggy bags are: PT100, PT500, PT1000, Thermocouple and 0-35 Vdc. When a piggy bag is mounted on the card all associated jumpers for the specific input on the analogue input card has to be removed. In case of a 0-10 Vdc or a 0-20 milliamp signal a piggy bag is not required see point 8.
5. Depending of the number of wires that are used for a PT100, PT500 or PT1000, a jumper for 2 or 3 wires can be set.
6. Description of the analogue input signal with the Terberg tag number.
7. Terminal to connect the PT100 at, X71 terminal 1-3.
8. A milliamp signal is connected to this input. A piggy bag is not required, the jumpers for "no PB" have to be connected and the type of input signal (voltage or milliamp) has to be selected with the jumper.

10.4. Using The Alarm Screens



A_a_list.bmp

In the “actual alarm list” all alarms or events in the system at this moment are listed. When an alarm is configured as ‘locked’, the alarm is removed only from the list when the ‘reset alarm button’ is pressed. The “Alarm Definition List” gives the possibility to select per alarm the required action. The alarms are placed in order of occurrence, a new alarm is added on the last position. If the SBC (not the IPC) is rebooted the alarms are updated and placed in number sequence. This screen can be selected from any other screen.

1. Alarm number.
2. Indication field for the alarm source, this makes it easier to trace alarms on the drawings:
 - Ixx.x, alarm is triggered by a digital input (example I00.2).
 - Alx.x, alarm is triggered by an analogue input (example AI0.2).
 - SOFTW, the alarm is not (directly) related to hardware.
 - PA, alarm generated by the power analyser.
3. Alarm text.
4. The first inhibited alarm, these are alarms temporarily disabled. Selection can be made in the “Alarm Definition List”.
5. Amount of inhibited alarms.
6. If an alarm is inhibited a message will be displayed.
7. Reset alarm button.
8. Scroll up in the actual alarm list.
9. Scroll down in the actual alarm list.

Terberg Control Systems

Documentation

 ALARM DEFINITION LIST									
Conf	Indicator/Tag	IO m.b	DESCRIPTION	Act	Standby	Inhibited	Inactive	Value	
	DI 115	DI 00.2	001:Local emergency shutdown					3599	1
	DI 171		002:Remote stop command					3078	2
	SW 1	SOFTW	003:Switched in 'hand off-load'					1670	3
	DI 121		004:Standby operation locked / not allowed					1606	4
	SW 1	SOFTW	005:Network 1 (IO bus) failed					3599	5
	SW 1	SOFTW	006:Network 2 (CPU bus) failed			Inhibit		3599	7
	DI 106		007:Stop on external time clock					2182	
	DI 19		008:Client system stop					2182	
	SW 1	SOFTW	009:Wait for Scada auto start					2582	
	DI 114		010:Field emergency stop shutdown					3599	6
	DI 49		011:'Normal shutdown' button pressed					3718	
	SW 1	SOFTW	012:Anti cycle delay		Not Act			134	
	SW 1	SOFTW	013:Maintenance required					2054	
	SW 1	SOFTW	014:Maintenance stop					2566	
	SW 1	SOFTW	015:Standby max. start resets					3598	
	DI 48		016:Selector switch 'auto' press 'start'					1666	
	SW 1	SOFTW	017:Selector switch 'off' position					3598	8
	DI 53		018:Manual synchronisation					1030	
	SW 1	SOFTW	019:Engine 'off load' time out				Not Act	646	
	SW 1	SOFTW	020:Gen mains fault recovery delay				Not Act	2062	

Status Engine Wait For Reset
 Alarm 001:Local emergency shutdown

Site Terberg Engine
 Date 06/04/05 Time 10:17:06

Home
Tree
Prev. Page
Next Page
Reset Alarm
Actual Alarm
Scroll Up
Scroll Down

Adllist.bmp

This screen gives an overview of all configured and selectable alarms. Not all alarms in the system are configured this is depending from the configured I/O. On every page 20 alarms can be visualised.

1. Actual status of the alarm, white means alarm not active, red means alarm active.
2. Terberg tag number.
3. Indication field for the alarm source, this makes it easier to trace alarms on the drawings:
 - Ixx.x, alarm is triggered by a digital input.
 - Alx.x, alarm is triggered by an analogue input.
 - SOFTW, the alarm is not (directly) related to hardware.
 - PA, alarm generated for the power analyser.
4. Alarm text with alarm number.
5. Alarm status, after possible conversions see point 6 till 8. White means alarm not active, red means alarm on.
6. The "standby" column to ignore alarm in standby mode.
7. In the "inhibit" column an alarm can be inhibited for a short period, this is a level 5 adjustment for service purpose. If a transducer fails, which is a non-essential alarm or backed up by a second device (analogue and digital protections), the alarm can be ignored until the device is replaced. Inhibiting an alarm also activates an alarm message.
8. Inactive is in the engineering / configuration level, herewith you can select if an alarm is actual available in the system.
9. Decimal indication of the configured action on this alarm, for more details see screen "Alarm Detail".
10. Button to scroll up through the alarms.
11. Button to scroll down through the alarms.

Terberg Control Systems

Documentation

ALARM DETAILS

Number	Alarm name	Index	Status	Standby	Inhibited	Inactive
1	001:Local emergency shutdown	1	On RE in historical alarm list			
Id Nmb	1					
0	Lock alarm	8	On RE in historical alarm list			
1	In actual alarm list	9	Alarm lamp			
2	In historical alarm list	10	Standby fault			
3	A stop : Direct stop	11	Call out alarm			
4	B stop : Rampdown cooldown	12	Critical alarm (All Engine's will)			
5	Spare	13	Pre alarm			
6	D stop : Direct open cooldown	14	Normal stop, but available			
7	Normal stop	15	Spare			

24

25 CANCEL Old value 3599 27

26 ACCEPT New value 3599 28

Status Engine Wait For Reset

Alarm 001:Local emergency shutdown

29 Number 5 30

Site Terberg Engine

Date 06/04/05 Time 10:17:06

Home Tree Prev. Page Next Page Reset Alarm Actual Alarm Scroll Up Scroll Down

Ad_view.bmp

For each alarm an individual action can be configured and adjusted by this screen. An action is the response of the installation when an alarm occurs, the selected action results in the way of stopping the engine, alarm presentation in actual or / and historical list, etcetera.

1. Position of the alarm in the list.
2. Alarm text with alarm number.
3. Actual status of the alarm, grey means alarm not active, red means alarm on.
4. Alarm ID number.
5. Possible actions on an alarm.
6. Indication for a selected action. Green indication when action is activated, grey when action is not selected.
7. Toggle button to select or deselect an action.
8. Lock function, the alarm is kept active until the alarm is cleared and the 'alarm reset' button is pressed.
9. Alarm is placed in the actual list on a rising edge and removed from the list on falling edge.
10. Alarm is placed in historical list including date and time sample.
11. A-stop: Mechanical fault, generator breaker will open and engine will stop directly (close fuel valve).
12. B-stop: Non-essential fault, engine will ramp down, open generator breaker and cool down the engine.
13. Spare position.
14. D-stop: Electrical failure, generator breaker will open and cool down the engine.
15. Normal stop, no alarm is generated, but engine will ramp down, open the generator breaker and will cool down. When a start command is received the installation will start up. As an example this is used for the stop button, time clock or an external stop.
16. Alarm is placed in the historical list on a rising edge; the falling edge of the alarm is ignored.
17. Alarm lamp and horn output is activated.

Terberg Control Systems
Documentation

18. Alarm is also active in standby mode of the generator set.
19. Call to base station.
20. On a critical alarm all engine will be stopped.
21. Pre alarm: on this alarm, set will only stop if another engine on same bus bar will takeover.
22. Normal stop, but available.
23. Spare position.
24. Indication that the alarm action is modified.
25. Ignore the changes and go back to the previous value (see point 6).
26. Accept the new value; the modifications will be down loaded to the SBC.
27. Actual, as configured in the processor, decimal representation of the alarm action.
28. New decimal representation of the re-configured alarm action.
29. Button to scroll up to the previous alarm.
30. Button to scroll down to the previous alarm.

Terberg Control Systems

Documentation



HISTORICAL ALARM LIST

Index	Date	Time	State	Alarm
001	19 / 02	03 : 01		001:Local emergency shutdown
002	19 / 02	03 : 01		255:ID 19 Gen winding temp L1 high - pre ala
003	19 / 02	03 : 01		150:Internal module failure
004	19 / 02	03 : 01		399:Panel not in auto control
005	19 / 02	03 : 01		399:Panel not in auto control (CPU bus) failed
006	19 / 02	03 : 01		399:Panel not in auto control (IO bus) failed
007	18 / 02	21 : 35		191:ID 23 Ambient air temp low
008	18 / 02	21 : 35		050:Oil pressure low
009	18 / 02	21 : 18		045:Jacket water outlet temp high
010	18 / 02	21 : 18		479:Jacketwater / OCAC level low
011	18 / 02	21 : 17		391:Jacket water temperature low warning
012	18 / 02	21 : 17		390:Oil pressure low warning
013	18 / 02	21 : 17		320:Jacket water temperature high warning
014	18 / 02	21 : 17		319:EMCP panel diagnostic failure
015	18 / 02	21 : 16		291:CAT control not in auto
016	18 / 02	21 : 16		216:Over crank fault
017	18 / 02	21 : 16		094:Over speed
018	18 / 02	21 : 16		079:Voltage regulator alarm
019	18 / 02	21 : 16		038:Fire alarm common fault
020	18 / 02	21 : 15		006:Network 2 (CPU bus) failed

Status Engine Wait For Reset

Alarm 001:Local emergency shutdown

Since 12:30
Number 5

Site Terberg Engine

Date 06/04/05 Time 10:17:06

Home
Tree
Prev. Page
Next Page
Reset Alarm
Actual Alarm
Scroll Up
Scroll Down

H_a_list.bmp

On this screen all the logged alarms in the SBC are listed. The system has the possibility to store 500 alarms in the historical list including date and time sample. The storage principle is a so called 'first in / first out' register, after 500 alarms the oldest data is overwritten by the new stored alarms. If an IPC is connected, the historical alarms are also stored on the hard disk for 1 year; this stored data is only available for a remote station.

1. List index, alarms are stored up to 500 positions.
2. Data information, format dd/mm; 19/02 indicating February the 2nd.
3. Time information, format hh/mm; 03:01 indicating 1 minute after 3 o'clock.
4. Alarm status:
 - A red rising line is shown when the alarm occurs.
 - A green falling line is shown when the alarm is off.
5. Alarm text with alarm number.
6. Button to scroll up through the alarms.
7. Button to scroll down through the alarms.

A

A_a_list Analogue Input.bmp, 31
A_a_list Digital Input.bmp, 26
A_a_list.bmp, 36
Ad_view.bmp, 38
Adllist.bmp, 37
Analogue Inputs.bmp, 32
Analogue Set Points.bmp, 33
Analyzing Alarm (Analogue Input), 31
Analyzing Alarm (Digital Input), 26
Anaout_2.bmp, 19, 23
Automatic Control In Multiple Engine Island, 4
Automatic Control In Parallel With Utility, 5
Automatic Control In Stand Alone Island, 3

B

Bb1_sett.bmp, 4
Block Diagram Speed Control, 22
Block Diagram Voltage Control, 18

C

CAN A-Out, 19, 23
Close Circuit Breaker, 12
Close Circuit Breaker.bmp, 12
Ctrlldfrq.bmp, 5

D

Digital Inputs.bmp, 27

E

Engine Cool Down, 15
Engine Cool Down.bmp, 15
Engine Idle -> Rated, 11
Engine Idle -> Rated.bmp, 11
Engine Off Load Run, 13
Engine Off Load Run.bmp, 13
Engine Pre Lube, 11
Engine Pre Lube.bmp, 11
Engine Purge Cycle (Gas Engine Only), 11
Engine Purge Cycle.bmp, 11
Engine Ramp Down, 15
Engine Ramp Down.bmp, 15
Engine Stabilisation, 12
Engine Stabilisation.bmp, 12
Engine Start, 11
Engine Start.bmp, 11
Engine Stopping, 16
Engine Stopping.bmp, 16
Engine Wait For Reset, 9
Engine Wait For Reset.bmp, 9
Engine Warming Up, 12
Engine Warming Up.bmp, 12
Example Hand Load.bmp, 7

F

Fault Analysis, 25

Frequency / Load Control, 21

G

General Alarm Indication, 25
General Alarm Indication.bmp, 25
Generator, 13
Generator control from master.bmp, 8
Graphic Diagram Voltage Control, 18

H

H_a_list.bmp, 40
Hand Load Control In Multiple Engine Island, 7
Hand Load Control In Parallel With Utility, 7
Hand Load Control In Stand Alone Island, 6

K

Key Switch Option 1.bmp, 3
Key Switch Option 2.bmp, 3
Key Switch Option 3.bmp, 3
Key Switch Option 4.bmp, 3

M

Modus Selection, 3

N

No voltage on bus bar, 12
Normal, 14
Normal Operation, 14

O

Open Generator Circuit Breaker, 15
Open Generator Circuit Breaker.bmp, 15
Operation Mode Automatic, 3
Operation Mode Hand Load, 6
Operation Mode Hand Off Load, 6
Operation Mode Off, 6

P

Page Analogue Input.bmp, 35
Page E-Stop.bmp, 30
Page Index.bmp, 28, 34
Page Input.bmp, 29
Pid3_kW.bmp, 24
Pid3_vlt.bmp, 20
Power Factor / Voltage Control, 17

R

Revisions, 43

S

Schedule Hz/kW Control, 22
Schedule voltage / power factor Control, 19
Selected Mode Combined With A Master, 8

Terberg Control Systems

Documentation

Signal Conversion Speed Control, 22
Start / Stop from master.bmp, 8
Start Up Protection, 12
Start Up Protection.bmp, 12
Start Up Sequence, 9
Stopping The Engine, 14
Synchronisation, 13
Synchronisation.bmp, 13

U

Using The Alarm Screens, 36
U-U Converter, 19, 23

V

Ventilation Engine Room (Gas Engine Only), 10
Ventilation Engine Room.bmp, 10
Voltage Matching, 13
Voltage Matching.bmp, 13
Voltage on bus bar, 12

W

Wait For Start, 10
Wait For Start, 16
Wait For Start After Failure, 16
Wait For Start After Failure.bmp, 16
Wait For Start.bmp, 10, 16

Terberg Control Systems
Documentation

Revisions:

Date	Revision	Chapter	Page	Subject
15/08/2005	0.0	All	All	Operation Manual
18/08/2005	0.1	10	25	Revision in text.
18/08/2005	0.1	10	26	Revision in text.
18/08/2005	0.1	10	31	Revision in text.
18/08/2005	0.1	All	All	Lay out changed to Control Systems
18/08/2005	0.1	1	3	Added new key switch.