

Compact Controller for Stand-by and Parallel Operating Gen-sets

ALL-IN-ONE^{NT}

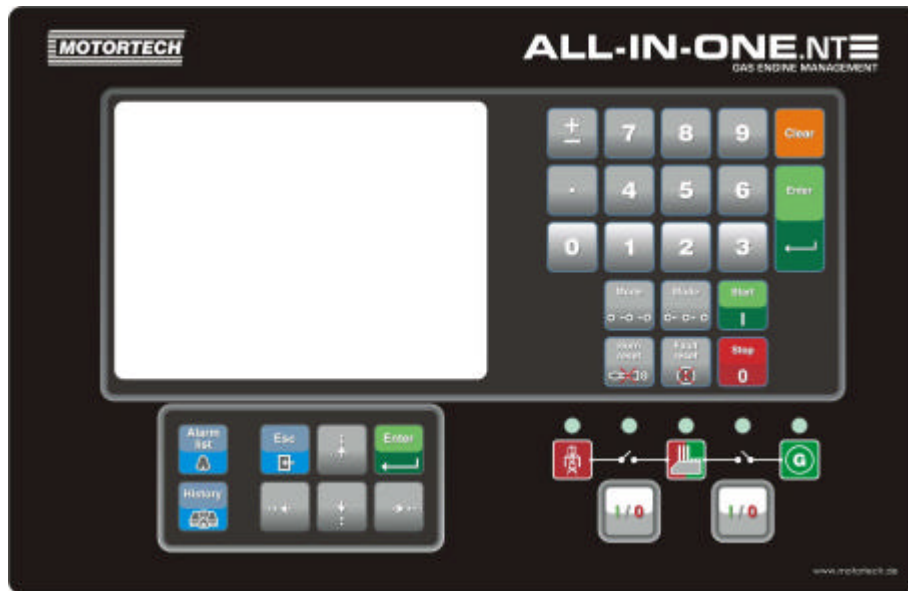
AFR Gen-set Controller

**Air Fuel Ratio controller for Lean burn
systems with SPI, SPtM, MINT, COX**

Software version IS-NT-AFR-1.0, November 2006

ALL-IN-ONE.NT

GAS ENGINE MANAGEMENT



Motortech GmbH
Hogreve Str. 21-23
D-29223 Celle
Tel : +49/(0)5141/9399-0
Fax : +49/(0)5141/9399-99

Table of Contents

Table of Contents	2
General guidelines	3
Description of the controller system	3
Available documentation.....	4
ALL-IN-ONE NT general manuals	4
ALL-IN-ONE NT application manuals	5
ALL-IN-ONE NT PC tools manuals	5
Common manuals	5
Conformity declaration.....	6
!! Warnings !!.....	6
Operator interface	7
ALL-ON-ONE ^{NT} pushbuttons and LEDs	7
Description of IntelliSys ^{NT} MEASUREMENT screens	12
Users and Passwords.....	18
Mode and function description	19
OFF mode.....	19
MAN mode	19
AUT mode.....	19
TEST mode (SPtM only).....	20
IS–NT Air Fuel Ratio control software	21
Hardware	22
Binary inputs	24
Binary outputs	25
Analog inputs	25
Logical analog values	26
Statistics values	27
Setpoints – Timers setting	28
Setpoints – Engine protect.....	28
Setpoints – AFR control.....	29
AFR control chart	34
Protections.....	35
History and Alarm list records	36
Tips and tricks	38
Abbreviation list.....	39

General guidelines

This manual provides general information on how to operate the IS-NT-AFR controller.

This manual is intended for everybody who is concerned with operation and maintenance of the gen-set.

Description of the controller system

NT family controllers are comprehensive AMF-controllers for single and multiple generating sets operating in stand-by or parallel modes. Synchronizer, isochronous load sharer, Mains and Generator protections allow for a total integrated solution for gen-sets in stand-by and parallel modes with multiple engine support.

NT family controllers are equipped with a powerful graphic display showing icons, symbols and bar-graphs for intuitive operation, which sets, together with high functionality, new standards in gen-set controls.

The controller automatically starts the gen-set, closes the gen-set C.B. when all conditions are met, then stops the engine on external signal or by pressing push buttons.

Parallel to Mains operation can be achieved without additional HW. Forward and reverse synchronizing, Mains protection including vector shift, load and power factor control, earth fault protection are the major functions provided. Interfacing to foreign synchronizers and load sharers is supported.

The key feature of NT family controllers is their easy-to-use installation and operation. Predefined configurations for typical applications are available as well as user-defined configurations for special applications.

Default applications

There are four default applications: SPI, SPtM, MINT, COX.

SPI	S ingle P arallel I sland application - for single gen-sets in parallel with mains or in island operation; suitable for CHP application; no MCB control
SPtM	S ingle P arallel t o M ains application - for single gen-sets in parallel with mains or in island operation, with AMF support; both MCB and GCB controlled
MINT	M ultiple application with I Nternal control loops - for multiple gen-sets in island parallel or mains parallel operation; Load Sharing and VAr Sharing controlled internally; PMS available
COX	A special application intended for C Ooperation with an eX ternal supervisory control system, e.g. PLC. Most internal control sequences are removed or reduced, all major actions (synchronizing, load control type) are initiated via binary inputs to the NT controller.

Available documentation

ALL-IN-ONE NT general manuals

IGS-NT-2.0-Application guide.pdf

Dedicated to gen-set control panel builders and project designers.

Covers above all following items:

- IG/IS-NT hardware options
- Comparison of number of I/O and communication ports in different HW modifications
- Order codes overview
- Applications overview – purpose, connection recommendations, function description
- PLC functions description
- Virtual peripherals – principle and usage

IGS-NT-2.0-Installation guide.pdf

Dedicated to gen-set control panel builders and everybody concerned with installation of the gen-set.

Includes information about following topics:

- Terminals and dimensions of all controllers and peripheral modules
- Recommended wirings
- Controllers' interface options
- Default sensors
- Speed governor interfaces
- AVR interfaces
- Technical data

IGS-NT-2.0-Operator guide.pdf

Dedicated to everybody concerned with operation and maintenance of the gen-set.

It describes

- Operator interface
- Measurement screens of the NT family controllers
- Modes and function of the controller.
- IG/IS-NT Available documentation list

IGS-NT-2.0-Troubleshooting guide.pdf

Includes description of possible troubles during configuration, adjustment and operation of the controller.

Consists of two parts:

- List of troubles and their solution
- How to ... section with recommended procedures in some typical situations

ALL-IN-ONE NT application manuals

For each application an appropriate manual is available:

IGS-NT-SPTM-2.0.pdf

IGS-NT-SPI-2.0.pdf

IGS-NT-MINT-2.0.pdf

IGS-NT-COX-2.0.pdf

They include these sections:

- Modes description (OFF, MAN, AUT, ...)
- Functions description (e.g. Load shedding, Power management, Start/Stop sequences)
- Protections and alarm management
- Gen-set operation states
- Inputs and outputs
- Setpoints
- List of abbreviations

ALL-IN-ONE NT PC tools manuals

InteliMonitor-2.0.pdf

This manual describes InteliMonitor monitoring PC tool in the following chapters:

- Connection to the controller (Direct, Modem, Internet)
- InteliDDE Server
- Menus description
- Password and access code

GenConfig-2.0.pdf

This manual describes GenConfig configuration PC tool in the following chapters:

- Connection to the controller (Direct, Modem, Internet)
- InteliDDE Server
- Menus description
- Controller configuration steps (Modules, I/O, Setpoints, Protections, History,...)

Common manuals

CommunicationGuide – September 06.pdf

This manual covers communication topics not only regarding IG/IS-NT controllers but also InteliLite and InteliDrive controllers. It applies to communication between the controller and superior service or monitoring system but not to communication among the controllers or between the controller and it's peripherals (extension modules, ECU).

It is divided into following chapters:

- Local connection
- Remote connection
- Modem connection
- Internet connection
- Active call, SMS, email
- Modbus description
- I-LB, IG-IB communication units
- Modem recommendations
- Recommended converters

Conformity declaration



Following described machine complies with the appropriate basic safety and health requirement of the EC Low Voltage Directive No: 73/23 / EEC and EC Electromagnetic Compatibility Directive 89/336 / EEC based on its design and type, as brought into circulation by us.

!! Warnings !!

Be aware that the binary outputs can change state during and after software reprogramming (before the controller is used again ensure that the proper configuration and setpoint settings are set in the controller)!!!

Be aware that gen-set can automatically or remotely start when following controller terminals are disconnected !!!

- Mains voltage measuring and / or
- Binary outputs for MCB control and / or
- MCB feedback

Switch IntelliGen^{NT} to OFF mode and disconnect the Binary outputs Starter and Fuel to avoid unexpected automatic start of gen-set and GCB closing.

!!! CAUTION !!!

Dangerous voltage

In no case touch the terminals for voltage and current measurement!
Always properly connect grounding terminals!

Take care when disconnecting In/Im3 terminals when the gen-set is stopped.
For safety connect parallel to controller In/Im3 terminals two anti parallel diodes 10A/100V.

In any case do not disconnect generator CT terminals when the gen-set is loaded.

Adjust set points

All setpoints are preadjusted to their typical values. But the setpoints in the “Basic settings” settings group **!!must!!** be adjusted before the first startup of the gen-set.

**!!! WRONG ADJUSTMENT OF BASIC PARAMETERS
CAN DESTROY THE GEN-SET !!!**

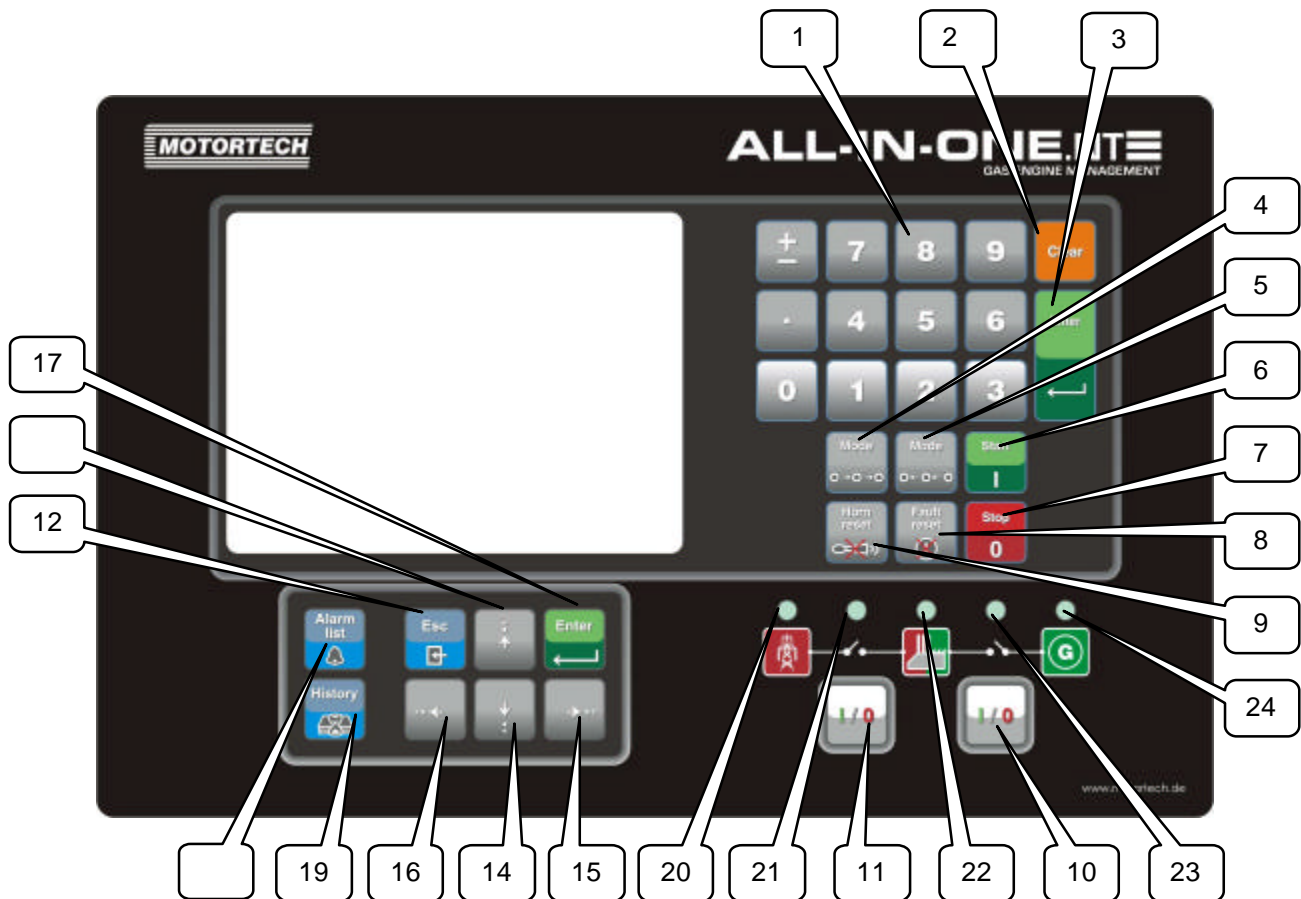
**The following instructions are for qualified personnel only.
To avoid personal injury do not perform any action not specified in this User guide !!!**

Note:

Motortech believes that all information provided herein is correct and reliable and reserves the right to update at any time. Motortech does not assume any responsibility for its use unless otherwise expressly undertaken.



Operator interface

ALL-ON-ONE^{NT} pushbuttons and LEDs



Pushbuttons:

1. Numeric keypad

Where	Function
Setpoints screen	Change setpoint value
Menu screen	Go to selected display group directly
Measurement screens	Go to another screen directly
Language screen	Select language directly
History screen	If pressed  button a  symbol appears on the display (bottom right corner) and it is possible to move by one page of records using arrow buttons

2. 
3. 

Clears character on the left side of the cursor, exits from menu

Where	Function
Menu screen	Go to selected display group (Measurement CU, Measurement IO, ...)
Measurement screens, Alarm list	Go to FastEdit screen (hold ENTER for 4 sec.) – then it is possible to adjust selected setpoint (typically Base load for standard SPtM)
Setpoints screen	Go to selected setpoint group
Setpoint edit	Start setpoint edit / save changes
History screen	Go to the first column of the first history record
FastEdit screen	FastEdit exit (to previous measurement screen) with setpoint change
Language screen	Language screen exit (to menu) and save selection

4. **Mode→** Cycle forward through gen-set operation modes OFF→MAN→ SEM→ AUT→ TEST.
5. **←Mode** Cycle backward through gen-set operation modes OFF←MAN←SEM←AUT ←TEST.
6. **START** Starts the gen-set in MAN or SEM mode.
7. **STOP** Stops the gen-set in MAN or SEM mode.
8. **FAULT RESET** Acknowledges faults and alarms.
9. **HORN RESET** Deactivates the horn (audible alarm).
10. **MCB ON/OFF** Opens and closes (synchronizes) the Mains circuit breaker in MAN mode (SPtM application only).
11. **GCB ON/OFF** Opens and closes (synchronizes) the Generator circuit breaker in MAN mode.
12. **ESC**



Where	Function
Measurement screens, Alarm list	Go to Menu screen
Setpoints screen	Go to Menu screen; within setpoint group, go to group list
Setpoint edit	Leave setpoint edit without changes
History screen	Go to Menu screen
FastEdit screen	Fast edit exit (to previous measurement screen) without changes
Language screen	Language screen exit (to menu) without save
Table of characters	Jump among table of characters, menu and text line

13. **↑** Select the setpoint, setpoint group, select the screen, select history record, increase setpoint value, edit stringlist value, select language
14. **↓** Select the setpoint, setpoint group, select the screen, select history record, decrease setpoint value, edit stringlist value, select language
15. **→** In AlarmList screen, shift the Alarm list page down (if more than 7 items), moves history record displayed columns to the right
16. **←** In AlarmList screen, shift the Alarm list page up (if more than 7 items), moves history record displayed columns to the left, go to Info screen
17. **Enter** Same as 3.
18. **Alarm list** Shortcut to Alarm list screen from any other screen
19. **History** Shortcut to History screen from any other screen

Pushbuttons' combinations

Following table determines controller functions when **↑**, **↓**, **←**, **→**, **ENTER** and **PAGE** buttons' combination is pressed:

Where	Pushbutton combination	Function
Measurement screens, Alarm list	ENTER + ↑	Contrast increase
	ENTER + ↓	Contrast decrease
	ENTER + ESC	Info screen

Info screen	ENTER +  ENTER + 	Backlight increase Backlight decrease
History screen	number + ENTER	Go to record with this number

LEDs:

- 20. Mains status LED
- 21. MCB status LED
- 22. Load status LED
- 23. GCB status LED
- 24. Gen-set status LED

How to select gen-set mode?

Use **MODE→** or **←MODE** to select requested gen-set operation mode OFF – MAN –AUT – TEST. It is not possible to go directly from OFF to AUT or TEST.

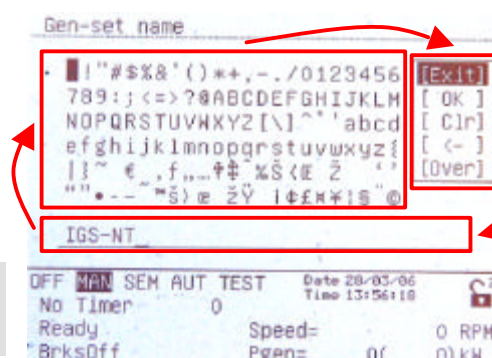
Display menus

There are several display menus (functions) available: ALARMLIST, MEASUREMENT CU, MEASUREMENT IO, SETPOINTS, HISTORY, PASSWORD and LANGUAGE.

Each menu consists of several screens. Pressing the **ESC** (repeatedly when necessary) button the menu screen will be displayed.

Hint:



IS-NT – When pressing **ESC** on the screen with characters, focus jumps from menu to bottom line and table of characters. See picture on the right.





How to view Alarm list?

1. Select the ALARMLIST menu item and press **ENTER** or press **←** in measurements' screens to go directly to the Alarm list.










How to view measured data?

1. Select the MEASUREMENT CU menu item and press **ENTER**.
2. Use  and  to select the screen with requested data.

How to view IO values?






1. Select the MEASUREMENT IO menu item and press **ENTER**.
2. Use  and  to select the screen with requested data.

How to view and edit setpoints?











1. Select SETPOINTS menu item and press **ENTER**.
2. Use  or  to select requested set points group.
3. Press **ENTER** to confirm.
4. Use  or  to select requested set point.
5. Set points marked  are password protected.
6. Press **ENTER** to edit.
7. Use  or  to modify the set point. When  or  is pressed for 2 sec, auto repeat function and speedup is activated. Use **←** or **→** to change the setpoint value by 5% of it's range.
8. Press **ENTER** to confirm or **ESC** to leave without change.
9. Press **ESC** to leave selected set points group.

How to view the HISTORY menu?





1. Select HISTORY menu item and press **ENTER**

2. Use  or  to select a requested record.
3. Use  or  to cycle forward/backward through columns of the record.
4. Press  to cycle through the whole screens of columns/rows.

How to change password?

1. Select USERS/PASSWORD menu item and press .
2. Use  or  to select User.
3. Press  to confirm.
4. Select ChangePassword and press .
5. Use  or  or  or  to set new password
6. Press  to confirm password

How to set Language?




1. Select LANGUAGE menu item (if not already selected) and press .
2. Use  or  to select a requested Language.
3. Press  to confirm.

Hint:

If binary inputs *Lang sel int A,B,C* (for IG-NT/EE internal display and IS-Display with address 1) or *Lang sel #2 A,B,C* (for IG-Display and IS-Display with address 2) or *Lang sel #3 A,B,C* (for IS-Display with address 3) are used, it is **not** possible to change languages from Language screen.

Language	0	1	2	3	4	5	6	7
Lang sel xxx A	0	1	0	1	0	1	0	1
Lang sel xxx B	0	0	1	1	0	0	1	1
Lang sel xxx C	0	0	0	0	1	1	1	1



How to change the display contrast?




Press and hold  and use  or  to adjust the best display contrast.

Hint:

Available from the MEASUREMENT screens only.

How to check the serial number and software revision?


Hold down the  and then press . On the display you can see controller INFO screen for 10 seconds.

InteliGen ^{NT}	InteliSys ^{NT}
Controller INFO screen contains: <ol style="list-style-type: none"> 1. Controller name (see Basic settings group) 2. Controller serial number (8 character number), SW version, ID string and release date 3. Application: SPtM, SPI, COX... Using  you can view the INFO2 screen which contains: <ol style="list-style-type: none"> 1. Display SW version 2. ID chip and Dongle content 3. Password decoding string 	Controller INFO screen contains: <ol style="list-style-type: none"> 1. Controller name (see Basic settings group) 2. Firmware and release date 3. Controller serial number (8 character number) 4. Application: SPtM, SPI, COX... 5. Password decode number 6. IS-Display version and release date 7. Encoding: available character sets Using  you can view the INFO2 screen which contains: <ol style="list-style-type: none"> 1. IDch: ID string 2. Dngl: connected dongle 3. Supported code pages Using  again you can view the INFO3 screen which contains: <ol style="list-style-type: none"> 1. IS-Display IDchip: ID string



Hint:




Available from the MEASUREMENT screens only.

How to view Connection screen on IG-Display?

Press  button when in Info screen to see information about IG-Display hardware version and properties and actual state of communication with the master controller.

How to change the display backlight intensity?

Hold down the  and then press . On the display you can see Controller INFO screen for 10 seconds.



Press and hold  when in INFO screen and use  or  to adjust the best display backlight. Backlight intensity is set for one of the two modes, depending on the activity of configurable binary input *Alt brightness* (IG-NT/EE and modifications). For IG-Display and IS-Display modules, this binary input is located in the Power connector and it's function is fixed (not configurable).

IS-Display with address 1 reads analog input *LCD brightness* on IS-NT-BB and changes accordingly display backlight intensity in the range 0-100%.



Hint:

Backlight intensity change available from the MEASUREMENT screens only.

How to find active alarms?

Select Alarmlist menu item and press  or press  in MEASUREMENT IO or MEASUREMENT CU menu.

Inverted alarms are still active. Non-inverted alarms are not active, but not yet confirmed.

Press  to accept all alarms (an asterisk mark disappears when an alarm is accepted by ). Non-active alarms immediately disappear from the list.

Active alarm list appears on the screen automatically when a new alarm comes up and Main MEASUREMENT screen was selected.

Hint:

Alarm list does not activate automatically if the display is switched to any other screen than the first one of MEASUREMENT (typically the screen that shows menu selector on the upper). The automatic jump to the alarm list screen will not occur if you are listing through the measured values, set points or history!

If setpoint **Engine protect:ResetActAlarms** is set to DISABLED, only inactive alarms can be reset.

If an active alarm is present in the alarm list, controller display blinks every 30 seconds.

When to use button?

The button is disabled in AUT mode.

In MAN and TEST modes it is enabled, but before closing of the circuit breaker, generator voltage and frequency must be within limits. The controller has internal protection to avoid the breaker closure without synchronizing.

The controller recognizes automatically:

- if there is mains / bus voltage and the gen-set shall be synchronized before closing the GCB
- or if there is no voltage on the bus and the GCB can be closed without synchronizing.

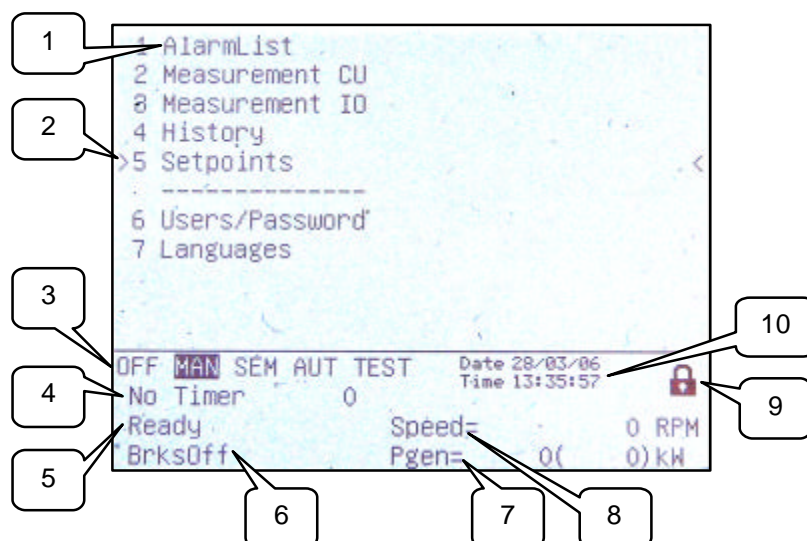
When to use button?

The button is disabled in AUT mode.



Use this button in MAN or TEST mode to close or open the MCB. **Be careful while doing this, because you can disconnect the load from the mains!!!**

Description of IntelliSys^{NT} MEASUREMENT screens

Main menu screen



1. Selection of alarm list, measurement, history, setpoints, languages or user screen.
2. Cursor shows actual selection.
3. Controller mode indication. Black background indicates active mode (MAN mode in the above example).
4. Timer – events counting time (e.g. prestart, cooling).
5. Engine machine state indication.
6. Electric machine state indication.
7. Actual gen-set power (requested gen-set power).
8. Actual RPM.
9. Indication of access level from the controller panel:

	Closed lock	No password set
	Opened lock	Password is set. Password level is visible in opened lock.

10. Controller date and time. Can be set in **Date/Time** group of setpoints.

1. Alarm list

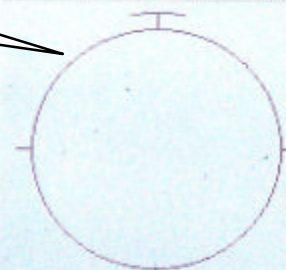
The screenshot shows the AlarmList screen. The menu items are: 1 AlarmList, 2 Measurement CU, 3 Measurement IO, 4 History, 5 Setpoints, 6 Users/Password, and 7 Languages. The status bar at the bottom displays: OFF MAN SEM AUT TEST, Date 28/03/06, Time 13:25:24, No Timer, 0, NotReady, BrksOff, Speed=, Pgen=, 0 RPM, and 0 kW. A lock icon is visible in the bottom right corner.

1. Details of the alarm from ECU indicated by the cursor are displayed at the bottom line (SPN, FMI, OC numbers)
2. Asterisk indicates not accepted alarms (Fault reset has not been performed)
3. Alarms displayed inverted are active
4. Number of active / not accepted / all alarms

2. Measurement CU

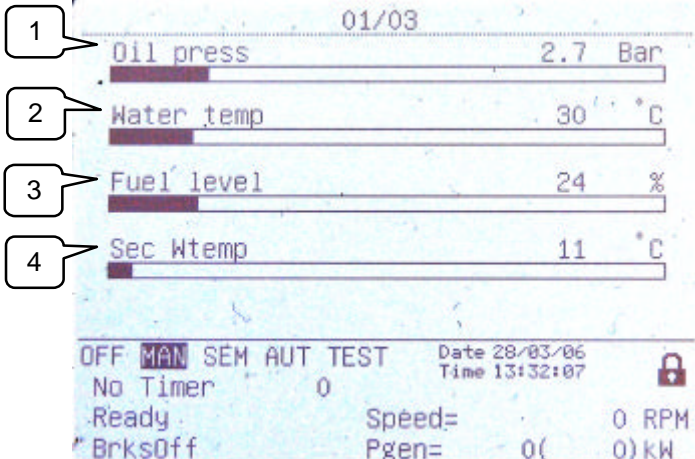
11 – SPtM Screens	Description
-------------------	-------------

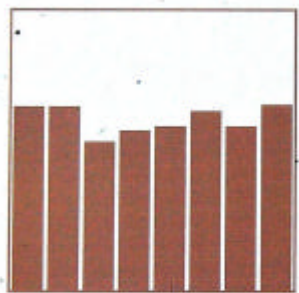
<p>01/08</p> <p>Act power kW 0</p> <p>RPM 0</p> <p>Pwr factor 0.00</p> <p>OFF MAN SEM AUT TEST Date 28/03/06 Time 11:05:32</p> <p>No Timer 0</p> <p>Ready Speed= 0 RPM</p> <p>BrksOff Pgen= 0(0) kW</p>	<ol style="list-style-type: none"> 1. Remote communication indication and access lock indication (symbol is visible when Access lock BI is active). 2. Actual gen-set power. 3. Measure screen address. For jump to this screen set this number from the numeric keypad. 4. Actual engine RPM. 5. Actual power factor.
<p>02/08</p> <p>None 0 kW</p> <p>None 0.00 0 kW</p> <p>0.00</p> <p>0 kW 0.00</p> <p>0 kW 0.00</p> <p>OFF MAN SEM AUT TEST Date 28/03/06 Time 11:04:48</p> <p>No Timer 0</p> <p>Ready Speed= 0 RPM</p> <p>BrksOff Pgen= 0(0) kW</p>	<ol style="list-style-type: none"> 1. Power control mode (Island / BaseLd / BldEmLm / Pwrl/E / TbyPwr) 2. PF control mode (Island / BasePF / PF I/E) 3. Required power value 4. Required PF value 5. Actual Mains active power and PF values 6. Actual load active power and PF values 7. Actual gen-set active power and PF values
<p>03/08</p> <p>Gen freq 0.0 Hz</p> <p>Gen V Ph-Ph 0 0 0 V</p> <p>Gen V Ph-N 0 0 0 V</p> <p>0 210 245 300</p> <p>Gen current 0 0 0 A</p> <p>0 300</p> <p>OFF MAN SEM AUT TEST Date 28/03/06 Time 11:05:53</p> <p>No Timer 0</p> <p>Ready Speed= 0 RPM</p> <p>BrksOff Pgen= 0(0) kW</p>	<ol style="list-style-type: none"> 1. Generator frequency 2. Generator voltage phase-phase 3. Generator voltage phase-neutral + triple bargraph 4. Generator current + triple bargraph
<p>04/08</p> <p>Mains freq 50.0 Hz</p> <p>Mains V Ph-Ph 0 0 0 V</p> <p>Mains V Ph-N 228 227 228 V</p> <p>0 210 245 300</p> <p>Im3/EarthFC 1 A</p> <p>0 650</p> <p>MaxVectorS 0.0 °</p> <p>OFF MAN SEM AUT TEST Date 28/03/06 Time 11:06:15</p> <p>No Timer 0</p> <p>Ready Speed= 0 RPM</p> <p>BrksOff Pgen= 0(0) kW</p>	<ol style="list-style-type: none"> 1. Mains frequency 2. Mains voltage phase-phase 3. Mains voltage phase-neutral + triple bargraph 4. Mains current (3rd phase)/ Earth fault current 5. Maximal vector shift

<div>05/08</div> <div>1 Act power 0 kW</div> <div>2 Pwr factor 0.00</div> <div>3 React power 0 kVAr</div> <div>4 Appar pwr 0 kVA</div> <div>05/08</div> <div>OFF MAN SEM AUT TEST Date 28/03/06 Time 11:06:48</div> <div>No Timer 0</div> <div>Ready Speed= 0 RPM</div> <div>BrksOff Pgen= 0(0) kW</div>	<ol style="list-style-type: none"> 1. Active power (total and per phase) 2. Power factor (total and per phase) 3. Reactive power (total and per phase) 4. Apparent power (total and per phase)
<div>06/08</div> <div>1 Ubat 22.5 V</div> <div>2 CPU temp 39.5 °C</div> <div>3 Dplus 0.0 V</div> <div>06/08</div> <div>OFF MAN SEM AUT TEST Date 28/03/06 Time 13:23:50</div> <div>No Timer 0</div> <div>Ready Speed= 0 RPM</div> <div>BrksOff Pgen= 0(0) kW</div>	<ol style="list-style-type: none"> 1. Battery voltage 2. CPU temperature 3. D+ voltage
<div>07/08</div> <div>1 </div> <div>2 Slip freq 49.98 Hz</div> <div>3 Angle #####</div> <div>4 Gen V 0 V</div> <div>5 Mains V 227 V</div> <div>6 Volt match 123 000</div> <div>7 SpdRegOut 0.000 V</div> <div>8 VoltRegOut 0.0 %</div> <div>07/08</div> <div>OFF MAN SEM AUT TEST Date 28/03/06 Time 13:24:16</div> <div>No Timer 0</div> <div>Ready Speed= 0 RPM</div> <div>BrksOff Pgen= 0(0) kW</div>	<ol style="list-style-type: none"> 1. Synchroscope 2. Slip frequency 3. Actual angle between generator and mains voltage 4. Generator first phase voltage 5. Mains first phase voltage 6. Voltage match of all three ph. (0—doesn't match; 1—OK) 7. SRO – Speed Regulator Output indication in the range SpeedGovLowLim – SpeedGovHiLim 8. VRO – Voltage Regulator Output indication in the range 0 – 100%
<div>08/08</div> <div>1 Run hours 1469 h</div> <div>2 Num starts 253</div> <div>3 NumUnscStarts 53</div> <div>4 Service time 1 400 h</div> <div>5 Service time 2 800 h</div> <div>6 Service time 3 65534 h</div> <div>7 Service time 4 65534 h</div> <div>8 kWhours 1256</div> <div>9 kVArhours 1658</div> <div>08/08</div> <div>OFF MAN SEM AUT TEST Date 28/03/06 Time 13:54:53</div> <div>No Timer 0</div> <div>Ready Speed= 0 RPM</div> <div>BrksOff Pgen= 0(0) kW</div>	<p>Statistics</p> <ol style="list-style-type: none"> 1. Total engine running hours 2. Total number of starts 3. Total number of unsuccessful starts 4. Service times (set in Engine protect group of setpoints) 5. Total gen-set kW hours 6. Total gen-set kVAr hours <p><u>Note:</u> Statistics can be set in IntelliMonitor ? Set statistics... after password of User 0 is entered.</p>

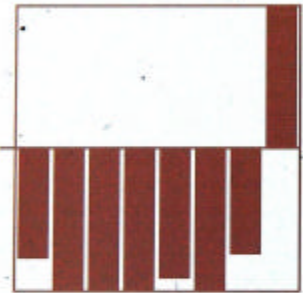
09/11	
kWhours Day kWhours kVARhous PulseCounter 1 PulseCounter 2 PulseCounter 3 PulseCounter 4	
10/11	
TimerAct T1-4 TimerAct T5-8 TimerAct T9-12 TimerAct T13-16	
11/11	
AFR control Mixer position Mixer feedback MAP required MAP actual MAT actual O2 actual Mixer mode	

Measurement IO

SPTM Screens	Description
 <p>1 Oil press 2.7 Bar</p> <p>2 Water temp 30 °C</p> <p>3 Fuel level 24 %</p> <p>4 Sec Wtemp 11 °C</p> <p>OFF MAN SEM AUT TEST Date 28/03/06 Time 13:32:07</p> <p>No Timer 0</p> <p>Ready Speed= 0 RPM</p> <p>BrksOff Pgen= 0(0) kW</p>	IS-NT analog inputs 1. Analog input 1 (e.g. Oil pressure) 2. Analog input 2 (e.g. Primary water temperature) 3. Analog input 3 (e.g. Fuel level) 4. analog input 4 (e.g. Secondary water temperature)

<div>02/03</div> <div><div>BIN0001000000000000</div><div><div>GCB feedback0Warning 90</div><div>MCB feedback0Warning 100</div><div>Remote S/S0SD 110</div><div>Emergency stopISD 120</div><div>AccessLock int0SD 130</div><div>Remote OFF0SD 140</div><div>Remote TEST0SD 150</div><div>Warning 80SD 160</div></div><div><div>OFFMANSEM AUT TEST</div><div>Date 28/03/06</div><div>Time 13:32:23</div><div></div></div><div>No Timer0</div><div>ReadySpeed=0 RPM</div><div>BrksOffPgen=0(0) kW</div></div>	IS-NT binary inputs indication
<div>03/03</div> <div><div>BOUT0000000010000000</div><div><div>Starter0ReadyI</div><div>Fuel solenoid0Running0</div><div>GCB close/open0Ready to load0</div><div>MCB close/open0Cooling pump0</div><div>Alarm0Bin OUT 130</div><div>Horn0Bin OUT 140</div><div>Prestart0Bin OUT 150</div><div>Idle/Nominal0Bin OUT 160</div></div><div><div>OFFMANSEM AUT TEST</div><div>Date 28/03/06</div><div>Time 13:32:41</div><div></div></div><div>No Timer0</div><div>ReadySpeed=0 RPM</div><div>BrksOffPgen=0(0) kW</div></div>	IS-NT binary outputs indication
<div>05/06</div> <div><div></div><div><div>165.7-</div><div>165.7-</div><div>133.7-</div><div>144.5-</div><div>147.7-</div><div>162.0-</div><div>148.2-</div><div>166.4-</div></div><div><div>OFFMANSEM AUT TEST</div><div>04/04/06</div><div>09:55:16</div><div>!</div><div></div></div><div>No Timer0</div><div>NotReadySpeed=0 RPM</div><div>MainsOperPgen=0(0) kW</div></div>	If the temperatures of cylinders are configured/measured it is possible to see bargraphs of these temperatures on the separate screen.

06/06



OFF MAN SEM AUT TEST

No Timer 0

NotReady

MainsOper

Speed= 0 RPM

Pgen= 0(0) kW

04/04/06
09:56:21

🔒

Another screen shows the differences of cylinder temperatures from the average temperature.

Further screens are automatically added if I/O extension modules or ECU are connected to the controller.

History

No.	Reason	Time	Date
0	Wrn Warning 8	13:25:13.8	28/03/2006
-1	Sd SD I2	13:25:06.4	28/03/2006
-2	Not ready	13:25:02.4	28/03/2006
-3	Sd SD I1	13:25:02.4	28/03/2006
-4	Wrn Warning 9	13:25:00.9	28/03/2006
-5	Terminal	13:07:16.0	28/03/2006
-6	Ready	13:07:16.0	28/03/2006
-7	Switched On	13:07:15.5	28/03/2006
-8	Ready	13:07:06.3	28/03/2006
-9	Fault reset	13:07:06.3	28/03/2006
-10	Not ready	11:50:59.3	28/03/2006
-11	Start fail	11:50:57.2	28/03/2006
-12	Gen start	11:49:39.2	28/03/2006
-13	Terminal	10:50:47.4	28/03/2006
-14	Ready	10:50:47.3	28/03/2006
-15	Switched On	10:50:46.1	28/03/2006
-16	Ready	10:45:33.0	28/03/2006
-17	Fault reset	10:45:33.0	28/03/2006
-18	Not ready	10:45:29.1	28/03/2006
-19	Start fail	10:45:27.0	28/03/2006
-20	Gen start	10:44:53.7	28/03/2006
-21	Terminal	10:37:24.5	28/03/2006
-22	Ready	10:37:24.4	28/03/2006

No. 0 Date 28/03/2006

Reason Wrn Warn Time 13:25:13.8

1. Bottom lines show record number, reason, date and time even if other columns are actually displayed

Users/Password

```

>0 - UO
1 - John
2 - Peter
3 - George
4 - -----
5 - -----
6 - -----
7 - -----

```

OFF MAN SEM AUT TEST Date 28/03/06

No Timer 0 Time 13:53:09

Ready Speed= 0 RPM


BrksOff Pgen= 0(0) kW

This screen shows list of users. To enter or change password of selected user press Enter.

Users and Passwords

Up to 8 users can be defined in the system. Every user has its own defined level of access rights. There are seven levels of password protection. User O – Administrator has always level 7.

Hint:

The lock mark  appears before a set point name (on controller screen) if the setpoint is password protected.

The lock mark is removed only when the password is set from controller's front panel.

The lock mark is still visible on controller screen even if the password is set from different terminal.



Even though one level may have been set from the front panel, the affected set points are not accessible from IntelliMonitor (direct or Modem) until this level is set in IntelliMonitor (direct or Modem).



Set point screen opened from front panel is automatically closed 15 minutes after the last key has been pressed.

It is possible to protect remote Start, Stop, GCB and MCB commands from IntelliMonitor. This seven level command protection can be configured in GenConfig.

EnterPassword

Password is a five-digit number (0 - 65535). Only setpoints associated with the entered password level can be modified.

Use  or  to select the desired password and then press **ENTER**.

Use  or  to move the value by 5% of the range.

Mode and function description

There are four gen-set operation modes: OFF - MAN – AUT – TEST in SPtM application. There are three gen-set operation modes: OFF - MAN – AUT in SPI, COX and MINT application.

To select the mode use **MODE→** or **←MODE**.

OFF mode

- No start of the gen-set is possible. Outputs STARTER, GCB CLOSE/OPEN and FUEL SOLENOID are not energized.
- No reaction if buttons **START**, **STOP**, **GCB ON/OFF** are pressed.
- MCB behavior depends on **AMF settings**: *MCB opens on setpoint*:
MAINSFAIL: When power-cut comes, MCB opens. After Mains returns, MCB closes with *MCB close del.*
GEN RUNNING: When power-cut comes, MCB stays closed until the gen-set starts and produces voltage within limits.

MAN mode

- 1) To start the gen-set press **START**.
- 2) When the generator voltage is within limits (adjusted in the setpoints group **Generator protections**) GCB green LED on the front panel lights.
- 3) Press **GCB ON/OFF** to close the GCB. If the generator voltage is out of the limits, controller does not respond to the **GCB ON/OFF**.
 - a) If controller detects dead bus, immediately closes GCB OPEN/CLOSE output.
 - b) If controller detects voltage on the bus, starts synchronizing.
- 4) To stop the engine press **STOP**
 - a) controller unloads the gen-set, opens GCB CLOSE/OPEN. Unloading is active only when binary input MCB feedback is closed or other gen-set is connected to bus. In other case GCB CLOSE/OPEN opens immediately.
 - b) Gen-set is cooled down and stopped.

Hint:

Controller does not respond to external signals and/or conditions. The gen-set is fully in manual control; there is no automatic way to stop it (except protections). The gen-set stays running until STOP button is pressed.

Controller does not take place in Power management in MINT application

AUT mode

Gen-set is controlled based on external signals (Rem start/stop, Sys start/stop) or conditions (AMF, Peak shaving, Power management system, ...).

Hint:

Engine does not stop, if other condition for automatic starts is active.

Example: If peak stop condition occurs, but REMOTE START/STOP is active, engine stays running.

Controller does not respond to **GCB ON/OFF**, **MCB ON/OFF**, **STOP**, **START** buttons and corresponding remote IntelliMonitor or Modbus commands.

Set **Basic setting**: *FltRes GoToMAN* = ENABLED to avoid automatic engine start when pressing **FAULT RESET** after Shut down or Slow stop alarm.

!!!! VERY IMPORTANT !!!!!

Engine can start automatically without warning when pressing **FAULT RESET** after shut down alarm.

TEST mode (SPtM only)

Use TEST mode for Gen-set start test if the Mains is OK or to transfer the load to the gen-set when Mains fail is announced in advance.

Hint:

The controller does not respond to **GCB ON/OFF**, **STOP**, **START** in *Ret from test* = AUTO.

Engine automatically starts, when TEST mode is selected.

Engine can start automatically without warning when pressing **FAULT RESET** after shut down alarm.

Baseload

Process control: *Load ctrl PtM* = BASELOAD

Gen-set power is kept at value given by **Process control:** *Base load* setpoint.

Internal Import export

ProcessControl: *Load ctrl PtM* = IMP/EXP

Process control: *IE measurement* = IM3 CT INPUT

Gen-set power is controlled to keep the import load at the level given by setpoint **Process control:** *Import load* value.

Controller measures Import/Export value via current transformers connected to In/Im3 terminal. The value of L3 is then multiplied by 3 to give an estimation of the actual Imp/Exp.

IS–NT Air Fuel Ratio control software

IS-NT-AFR-1.0 is based on standard IntelliSys-NT software of version 2.0 and the last standard IS-AFR-1.5 version. IS-AFR software is compatible with IntelliMonitor-2.0 and GenConfig-2.0 PC tools. Corresponding IS-AFR dongle activates IS-AFR function. Following document describes differences against standard IS-NT functions only. For standard IntelliSys functions description see corresponding (SPTM, SPI, MINT) user guides.

IS-NT-AFR-1.0.igc pack

Use GenConfig –Option-Import firmware command to import igc pack to GenConfig.

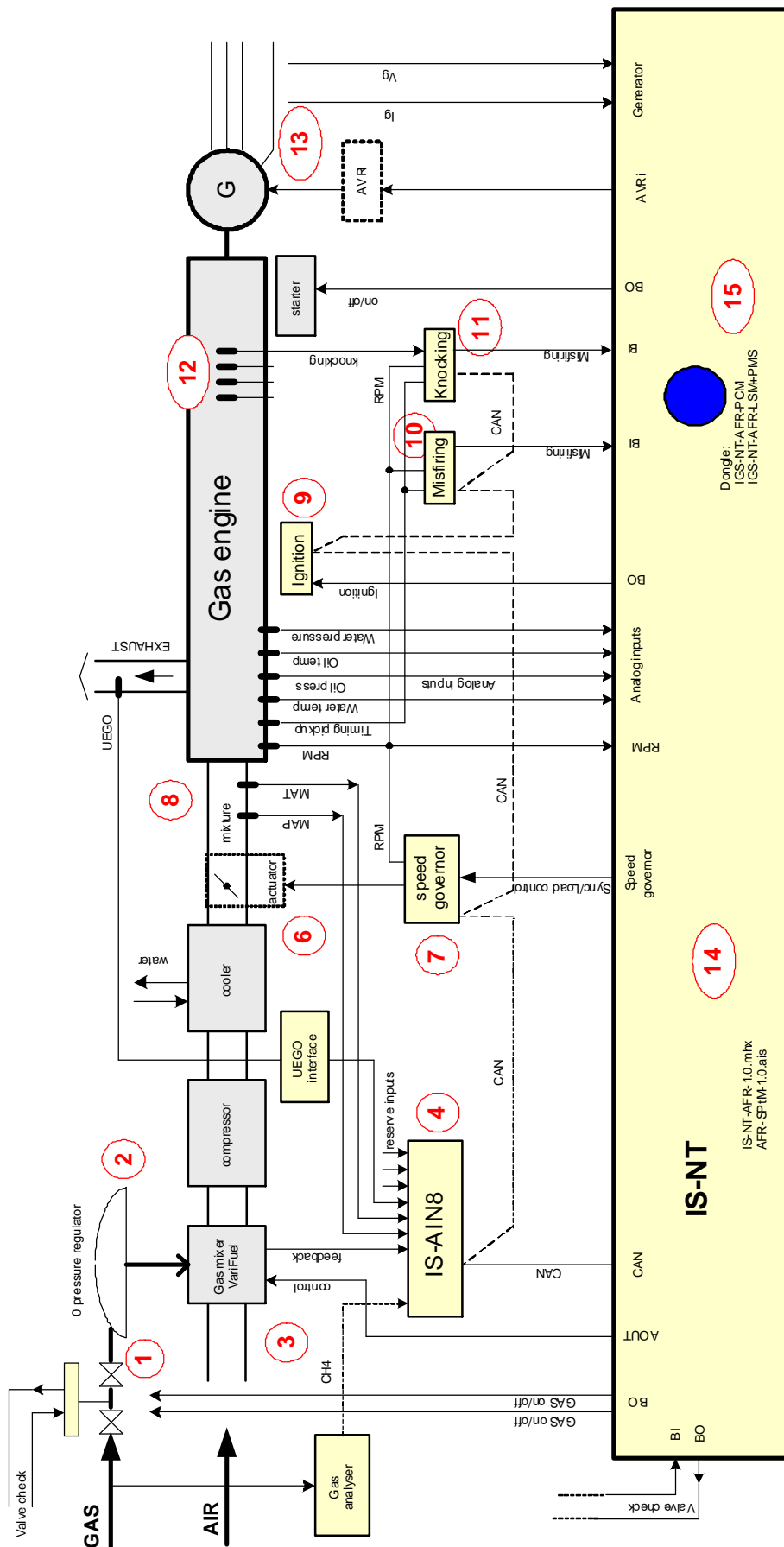
File	Note
IS-NT-AFR-1.0.mhx	Application processor
IS-display-1.1.mhd	Display processor
IS-Display-1.1.ntd	Display processor
IS-font-china-1.0.ifo	China font file
IS-NT-AFR-1.0.NTF	Info file
IS-AFR-COX-1.0.ant	Default archives
IS-AFR-MINT-1.0.ant	
IS-AFR-SPI-1.0.ant	
IS-AFR-SPTM-1.0.ant	
IS-AFR-SPTM-StarterKit-2.0.ant	
VDO Level CU.CRV	Default sensors
VDO Press CU Bar.CRV	
VDO Press CU Psi.CRV	
VDO Temp CU °C.CRV	
VDO Temp CU °F.CRV	
ENG_CHN.trn	China Dictionary
Eng_esp.trn	Spain dictionary
10_134_1_5.IDX	Index file

Available documentation

PDF files	Description
IS-NT-AFR-1.0 Abstract.pdf	AFR functions description
GenConfig-2.0.pdf	Manual for PC configuration tool
IntelliMonitor-2.0.pdf	Manual for PC monitoring tool
Related documents	
IGS-NT-MINT-2.0.pdf	Manual for standard IG/IS-NT Multiple INTERNAL application
IGS-NT-2.0-Application guide.pdf	Application guide for IG/IS-NT
IGS-NT-2.0-Installation guide.pdf	Installation guide for IG/IS-NT
IGS-NT-2.0-Operator guide.pdf	Operator guide for IG/IS-NT
IntelliCommunicationGuide–September06.pdf	Communication guide for IG/IS-NT, ID and II controllers

Main changes against the standard IS-AFR-1.5

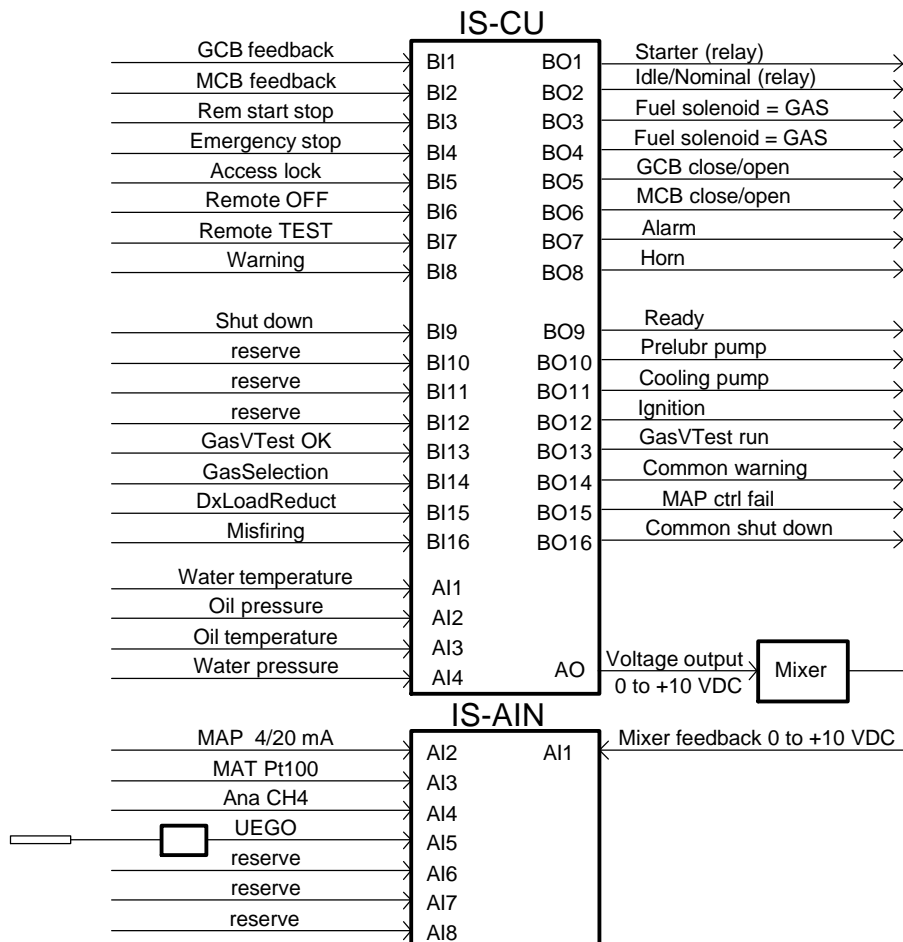
1. New setpoint limit **Engine protect:** [StartOverspeed \[% \]](#) .
2. New setpoint **Engine protect:** [StartBlockDel \[s \]](#) .
3. New setpoint **Engine protect:** [ServiceTime Sd \[h \]](#).
4. New Logical binary output *kWh pulses* and corresponding setpoint AFR control: [kWh pulse \[kWh \]](#).
5. Removed message “Wrn SpeedRegLimit” in alarm list and in History record.
6. Removed Stop fail indication.
7. New Logical analog input: LdCtrl:AnExBld for Local Baseload from analog input setting (as part of standard IS-NT system).
8. New programmable logic functions PLC set (as part of standard IS-NT system).



IS-NT-AFR Dongles option

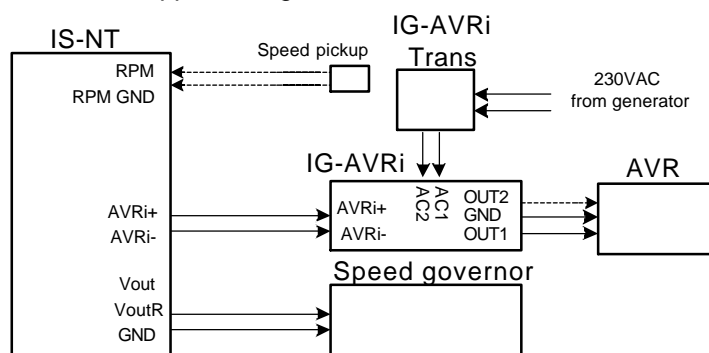
Single parallel SPtM / SPI	Multiple+power management MINT
IGS-NT-AFR-PCM	IGS-NT-AFR-LSM+PMS

Wiring example of binary and analog I/O



Wiring example of IS-NT speed governor and AVR interface

More details see in Application guide.



Possible extension modules

Module	Binary inputs	Binary outputs	Analog inputs	Analog outputs
IGS-PTM	8	8	4	1
IS-BIN16/8	16	8	-	-
IS-AIN8	-	-	8	-
I-AOUT8	-	-	-	8
IGL-RA15	-	15 LED	-	-

Hint:

More detail for extension modules configuration see in corresponding IntelliSys, IGS-PTM or IGL – RA15 user guide.

Binary inputs

Hint:

Following list contains inputs/outputs related to Air Fuel Ratio control only. For standard I/O list please see standard IntelliSys application manuals.

Previous GasSelection input – was replaced by Force setpoint function.

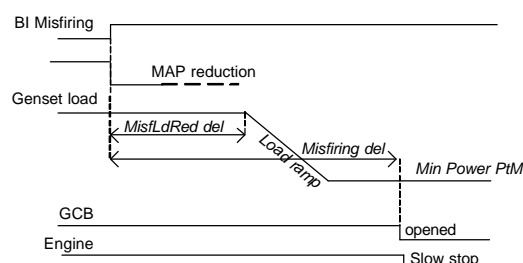
Misfiring

Misfiring binary input activates IS-NT-AFR engine misfiring protection. Misfiring is detected from external misfiring unit. Protection is active only when gen-set power is above *Low MAP power*.

When binary input is active:

- Immediately reduces required MAP value by setpoint **AFR control: MisfMAP reduct**
- Starts engine unloading after **AFR control: MisfLdRed del** with rate **Sync/Load ctrl: Load ramp** to value **Gener protect: Min Power PtM**.
- Activates Engine Slow stop (Cool down) after **AFR control: Misfiring del**.

The engine shut down is activated when Misfiring unload protection is activated 5 times in one hour (Alarm list and History record Sd Misfiring). The internal (modulo 5) counter is reset after one hour without Misfiring activation or after engine Stop.



DxLoad reduct

Input activates IS-AFR engine knocking protection. Knocking is detected from external unit. Protection is active only when gen-set power is above *Low MAP power*.

When is closed:

- Immediately starts engine unloading with rate **Sync/Load ctrl: Load ramp** to value **Gener protect: Min Power PtM**.
- Activates Engine shut down after **AFR control: Knocking del**.

The engine shut down is activated when binary input DxLoad reduct is activated 5 times in one hour (Alarm list and History record Sd Knocking). The internal (modulo 5) counter is reset after one hour without Knocking activation or after engine Stop.

GasVTest OK

Binary input from Gas valve test unit that indicates OK result of Gas valve test.

Binary outputs

IS-AFR Timer Active output was replaced by standard IS-NT timer function.

MAP ctrl fail

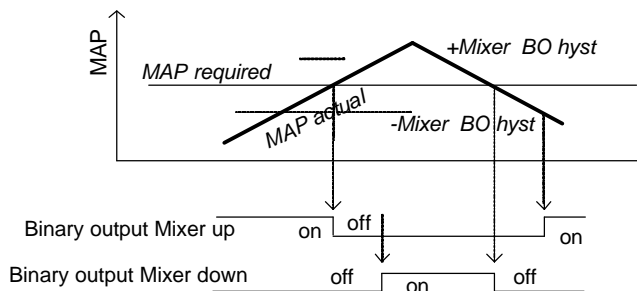
Binary output is closed when MAP characteristic is out of control range. See protection MAP control fail.

Mixer up

Output for binary Up/Down Mixer control.

Mixer down

Output for binary Up/Down Mixer control.



Hint:

Binary outputs Mixer up and Mixer down are not active when analog input Mixer feedback is not configured.

GasVTest run

Output for Gas valve test activation.

kWh pulses

Based on **AFR control**: *kWh pulses* setpoint this output generates 1 sec pulse. kWh value starts calculating from setpoint change.

Analog inputs

MAT

Analog input for Manifold mixture temperature.
Engine Slow stop (Cool down) is activated when MAT sensor fail is detected.

MAP

Analog input for Manifold mixture pressure – recommended resolution of sensor characteristics is 0,1 Bar. Engine Shut down is activated when MAP sensor fail is detected.

Ana CH4

Gas content influences Mixer position during engine start and running unloaded state when setpoint **AFR control**: *Ana CH4* = ENABLED. In this case the setpoints *StartPosition1*, *RunPosition1*, *StartPosition2*, *RunPosition2* are ignored.

Hint:

StartPosition.. and *RunPosition..* setpoints are used when Ana CH4 sensor fail is detected (sensor value is out of range).

Connect external gas analyzer to analog input Ana CH4 and configure corresponding sensor characteristics with respect to 0 to 100% Mixer control output range.

Configuration example

Property	Value
Name	MAP
Dim	bar
Sensor	4-20mA active
Resolution	0,001
Sensor range	10,000
Protection	No protection
Active when	
Block type	
Bargraph 100%	10,000
Function	MAP
Cylinders	In-line engine

Property	Value
Name	MAT
Dim	°C
Sensor	PT100,°C
Resolution	0,1
Sensor range	0,0
Protection	Wrn+Stp
Active when	Over limit
Block type	RunOnlyBlkDel1
Bargraph 100%	200,0
Function	MAT
Cylinders	In-line engine

Property	Value
Name	Ana CH4
Dim	%
Sensor	4-20mA active
Resolution	0,1
Sensor range	100,0
Protection	No protection
Active when	
Block type	
Bargraph 100%	100,0
Function	Ana CH4
Cylinders	In-line engine

UEGO

Input for UEGO sensor signal (from UEGO interface unit). It is not possible to connect UEGO sensor directly without interface unit. Configure sensor characteristics corresponding to UEGO interface unit output signal in IS-AIN8.

UEGO corresponding setpoints: **AFR control:** *Diff O2*, *Diff O2 del*.

Protection: Engine Slow stop (cool down) when actual UEGO value is out \pm *Diff O2* for *Diff O2 del*.

Protection is active when genset power is higher than *Low MAP power*.

Configure sensor characteristics with one decimal point i.e. format 10,0%.

Mixer fdb

Analog input for mixer feedback position. Mixer feedback is used for binary mixer position control only and it is not used for mixer control via analog output (indication only). Mixer feedback sensor characteristics must be configured in the range 0,0 to 100,0% to be the same dimension as Mixer position output.

Logical analog values

Mixer position [0,0 to 100,0%]

Configure this output to IS-NT physical analog output 0 – 10V (0 – 20 mA) for mixer control.

IS-NT Mixer position output conversion to IS-NT physical analog output

Property	Value
Source	Mixer position
Convert	Yes
Lo limit	0,0
Hi limit	100,0
Normalize	Yes
Resolution	0,1

AFR control	
Mixer position	<input checked="" type="checkbox"/>
Mixer feedback	<input type="checkbox"/>
MAP required	<input type="checkbox"/>
MAP actual	<input type="checkbox"/>
MAT actual	<input type="checkbox"/>
O2 actual	<input type="checkbox"/>

Mixer feedback [0,0 to 100,0%]

Actual value based on Mixer fdb input.

MAP required [0,000 to 10,000 bar]

Final MAP required including temperature correction.

MAP actual [0,000 to 10,000 bar]

actual [MAP](#) based on MAP analog input.

O2 actual [0,0 to 100,0%]

Actual O2 value based on UEGO analog input.

Statistics values

Following statistics value is additional against to standard IntelliSys NT software.

kW hours

Day kWhours

- Visible on Generator [1-5] screen or in WinEdit - Value screen
- It is automatically set to zero each midnight (24:00:00) when controller is switched on

kVARhours

Run hours

Num starts

NumUnscStarts

Service time 1

Service time 2

Service time 3

Service time 4

Hint:

Once a service time has elapsed the corresponding *Service time X* setpoint must be adjusted again to a konzero value to clear the alarm and begin a new countdown. You can rename the particular timers using Translator to indicate specific service intervals – e.g. “OilChange time”, “SparkPlug time”, ...

PulseCounter 1

PulseCounter 2

PulseCounter 3

PulseCounter 4

The inputs are linked with corresponding counters, which integrate the pulses sensed at these inputs. Each rising edge of the signal at input increases the internal counter value.

Hint:

Pulse width (both high/low levels) must be at least 100 ms in order to be correctly sensed!
Conversion ratio can be selected using the setpoints *ConvCoefPulseX*. The converted values are visible in statistics – values *PulseCounter X*. These values can be reset using Statistics window in IntelliMonitor.

Setpoints – Timers setting

There is 16 channels, each defines occurrence date and time (year, month, day, hour, minute), duration time (in minutes, maximum is 24*60), repeating period (day, week, month, once). In case of week – day of the week selection, when should be executed + selection of repeating (every 1st, 2nd, 3rd or 4th week); In case of month – day of the month selection (e.g. every 3rd day or every 2nd Monday) Every channel can be disabled by blocking input. If blocking input is active then the timer is not activated even if it should be, according to it's other settings.

The channels are divided into groups of 4. Each group has independent binary output, which activates if any of the 4 channels within the group is active (1-4, 5-8,...). There is also one common output for all 16 channels.

Hint:

Engine can start after controller is switched from MAN to AUT mode or when controller is switched ON in AUT mode when Timer is active !!!

Baseload FastEdit

It is possible to change setpoint **ProcessControl: Base load** from controller panel instead from Process control setpoint group:

1. Press button on controller numeric keyboard to open Fast Edit screen. There is actual value and limits.
2. Change Baseload value using UP/DOWN (±1 increment with auto repeat) or LEFT/RIGHT (±10% of Nominal power increment) arrow keys.
3. Press to confirm value or to escape Fast edit screen.

Setpoints – Engine protect

The only Air Fuel Ratio specific setpoints are listed below. For other setpoints list and description refer to standard IGS-NT User guides.

Overspeed [%]

Threshold for engine over speed protection – active all time.

Step: 1% of *Nominal RPM*

Range: 0 – 200%

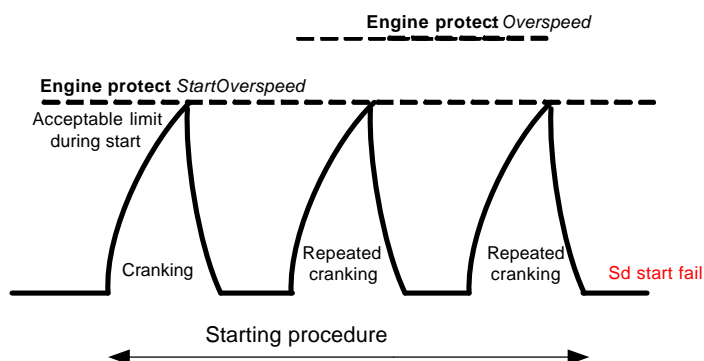
StartOverspeed [%]

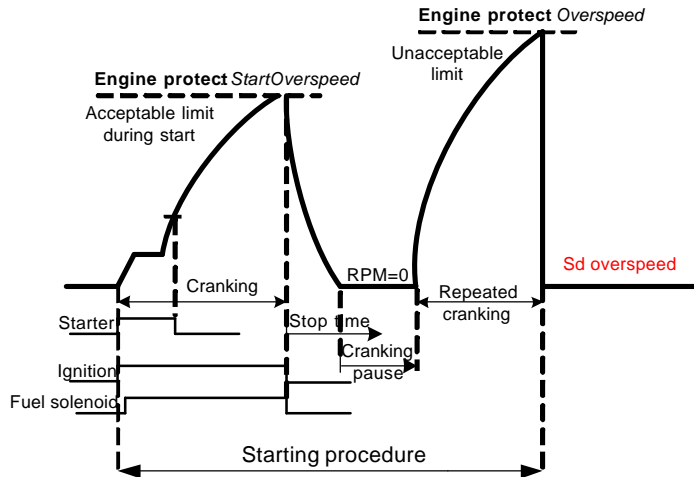
RPM limit without delay:

- During the starting procedure: stops the engine and initiates new starting attempt (without Fault) reset until reaches the **Engine params: Cranking attempts** number.
- Initiate Engine shut down after engine is running.

Step: 1% of *Nominal RPM*

Range: 0 – 200%



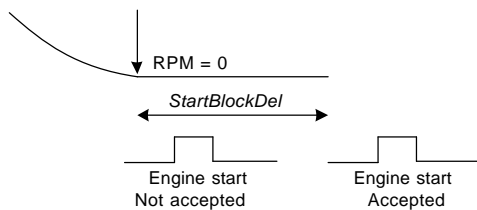


StartBlockDel [s]

Time limit within the next (automatic or manual) engine start is blocked after engine was stopped. No block when set to zero.

Step: 1 s

Range: 0 to 60000 s



ServiceTime Sd [h]

Engine will stop (cooldown) after this value counts down to zero.

Step: 1 h

Range: 0 to 65535 h

Setpoints – AFR control

GasVTEST [ENABLE / DISABLE]

ENABLE: Binary output GasVTest run (Gas valve test) is activated before each engine start by:

- Binary input Rem start/stop in AUT mode,
- START button in MAN and SEM mode,
- In TEST mode when is not Mains fail.

DISABLE: Engine starts after start command without Gas valve test.

Hint:

Gas Valve TEST procedure is skipped during Automatic Mains Fail gen-set start to short black-out time.

Active sprinkler function enables engine start even if the Gas valve test is negative.

GasVTest del [s]

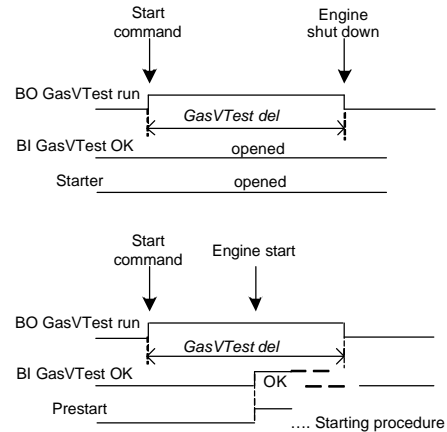
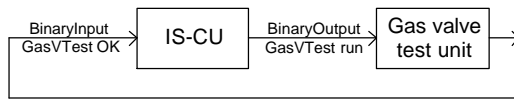
Binary output GasVTest run starts Gas valve test procedure and timer *GasV TEST del*.

Engine starts when Binary input GasVTest OK (test feedback) is activated (closed) during *GasVTest del*.

Engine shut down protection is activated when no GasVTest feedback is detected during *GasVTest del.*

Step: 1 s

Range: 0 to 300 s



StartPosition [%]

Mixer fix position for Engine start when Binary input GasSelection is opened.

Step: 0,1 %

Range: 0,0 to 100,0 %

RunPosition [%]

Mixer fix position after engine reaches Nominal RPM when GCB is opened. Position is active when Binary input GasSelection is opened.

Step: 0,1 %

Range: 0,0 to 100,0 %

LoPwrPosition [%]

Mixer low power fix position after GCB is closed until gen-set reaches *Low MAP power*. Position is active when Binary input GasSelection is opened.

Step: 0,1 %

Range: 0,0 to 100,0 %

Hint:

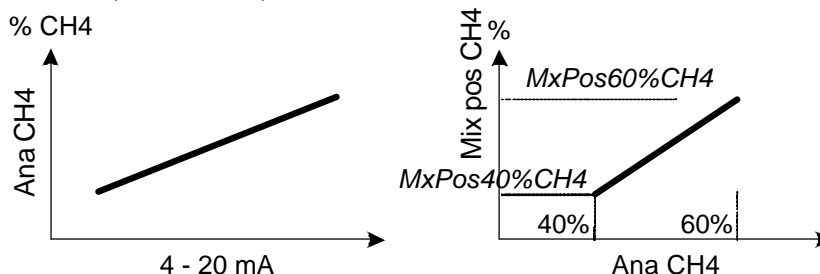
Use Force value function to force different value of StartPosition, RunPosition and LoPwrPosition.

MxPos40%CH4, MxPos60%CH4 [%]

Setpoints for transformation from CH4 content to Mixer position output. This function is active when Ana CH4 = ENABLED.

Step: 0,1 %

Range: 0,0 to 100,0 %



Example:

Setting MxPos40%CH4 = 40% and MxPos60%CH4 = 60% means linear 1:1 transformation between CH4 and Mixer position.

Ana CH4 [DISABLED / ENA-FIX / ENA-STEP]

DISABLED	Mixer position for engine start and running unloaded (< Low MAP power) is defined by setpoint AFR control : <i>StartPosition1</i> or 2 and <i>RunPosition1</i> or 2 and <i>Lo Pwr position 1</i> or 2.
ENA-FIX	Mixer position for engine start, running unloaded (GCB opened) and is defined by analog input Ana CH4 (via configured characteristic <i>MxPos40%CH4</i> , <i>MxPos60%CH4</i>).
ENA-STEP	Mixer output = ENA-FIX + corresponding difference between active (depends on Binary input Gas selection) <i>StartPosition</i> , <i>RunPosition</i> and <i>LoPwr position</i> .

... see table below

Ana CH4:	Start	Run	< Lo MAP power	> Lo MAP power
DISABLE	<i>StartPosition1</i> <i>StartPosition2</i>	<i>RunPosition1</i> <i>RunPosition2</i>	<i>LoPwr position1</i> <i>LoPwr position2</i>	PID control
ENA-FIX	The mixer output depends on AnaCH4 input (corresponding sensor characteristics) and setting of <i>MxPos40%CH4</i> and <i>MxPos60%CH4</i>			PID control
ENA-STEP	= ENA-FIX	= ENA-FIX + Dif1	= ENA-FIX + Dif2	PID control

Dif1 and Dif2 depends on Binary input Gas selection - see below

Binary input Gas selection	= opened	= closed
Dif1 =	<i>RunPosition1</i> - <i>StartPosition1</i>	<i>RunPosition2</i> - <i>StartPosition2</i>
Dif2 =	<i>LoPwr position1</i> - <i>StartPosition1</i>	<i>LoPwr position2</i> - <i>StartPosition2</i>

Low MAP power [kW]

MAP characteristic specification: gen-set power for *Low MAP* value and kW power limit for AFR PID Mixer control loop activation.

Step: 1 kW

Range: 0 to *High MAP power*

High MAP power [kW]

MAP characteristic specification: gen-set power for *High MAP* value.

Step: 1 kW

Range: *Low MAP power* to *Nominal power*

Low MAP [Bar]

MAP characteristic specification: MAP value at *Low MAP power*.

Step: 0,001 Bar

Range: 0,000 to *High MAP*

High MAP [Bar]

MAP characteristic specification: MAP value at *High MAP power*.

Step: 0,001 Bar

Range: *Low MAP* to 10,000 Bar

Low O2 [%]

Oxygen content at *Low MAP power*.

Step: 0,1 %

Range: 0,0 to *High O2*

High O2 [%]

Oxygen content at *High MAP power*.

Step: 0,1 %

Range: *Low O2* to 20,0 %

Diff O2 [%]

Allowed \pm difference from O2 characteristic.

Step: 0,1 %

Range: 0,0 to 20,0 %

Diff O2 del [s]

Slow stop (cool down) is activated when O2 is out of range for *Diff O2 del*.

Step: 1 s

Range: 0 to 600 s

Mixer MODE [MANUAL / AUTOMATIC / AUT-PAR]

MANUAL Mixer position is defined only by setpoint *Mixer position* in all engine states.

AUTOMATIC Automatic mixer control that activated after GCB is closed and gen-set load above *Low MAP power* (in island and parallel to mains mode).

AUT-PAR Automatic Mixer control only in parallel to mains (MCB is closed)

Mixer position [%]

Mixer position when Mixer MODE = TEST.

Step: 0,1 %

Range: 0,0 to 100,0 %

Mixer BO hyst [%]

Hysteresis for Mixer binary control via Binary outputs Speed up, Speed down. See chapter [Binary outputs](#).

Step: 0,1 %

Range: 0,0 to 100,0 %

AFR gain [%]

Gain for AFR control loop.

Step: 0,1 %

Range: 0,0 to 200,0 %

AFR int [%]

Integration factor for AFR control loop.

Step: 1 %

Range: 0 to 100 %

Rough calculation of speed of Mixer position output change in % per 1 minute

$$\%/min = - (AFR\ int * ?) / 1000$$

Where:

AFR int = setpoint 0 to 100%

? = difference in Bar between requested and actual MAP - se table below.

MAP requested	MAP actual	?
60,0 Bar	50,0 Bar	100

Example: *AFR int* = 50%; ? = 100; %/min = - 50 * 100 / 1000 = - 5 %/min.

Mixer position output speed does not depend on *AFR gain* setting.

AFR der [%]

Derivation factor for AFR control loop.

Step: 1 %

Range: 0 to 100 %

MisfMAP reduct [Bar]

Required MAP value is immediately reduced by this value when binary input Misfiring is active.

Step: 0,001 Bar

Range: -1,000 to 1,000 Bar

MisfLdRed del [s]

The engine load is reduced after *MisfLdRed del* when binary input Misfiring is activated.

Step: 1 s

Range: 0 to *Misfiring del* s

Misfiring del [s]

Engine cool down protection is activated when binary input Misfiring is activated for *Misfiring del*.

Step: 1 s

Range: *MisfLdRed del* to 600 s

Knocking del [s]

Engine shut down protection is activated when binary input DxLdReduct is activated for *Knocking del*.

Step: 1 s

Range: 0 to 600 s

MAP difference [Bar]

Allowed \pm difference from MAP characteristic (*Low MAP, High MAP*).

Step: 0,001 Bar

Range: 0,000 to 1,000 Bar

MAP timeout [s]

Engine shut down is activated when actual MAP is out of characteristics (*MAP difference*) for MAP timeout.

Step: 1 s

Range: 0 to 600 s

kWh pulse [kWh]

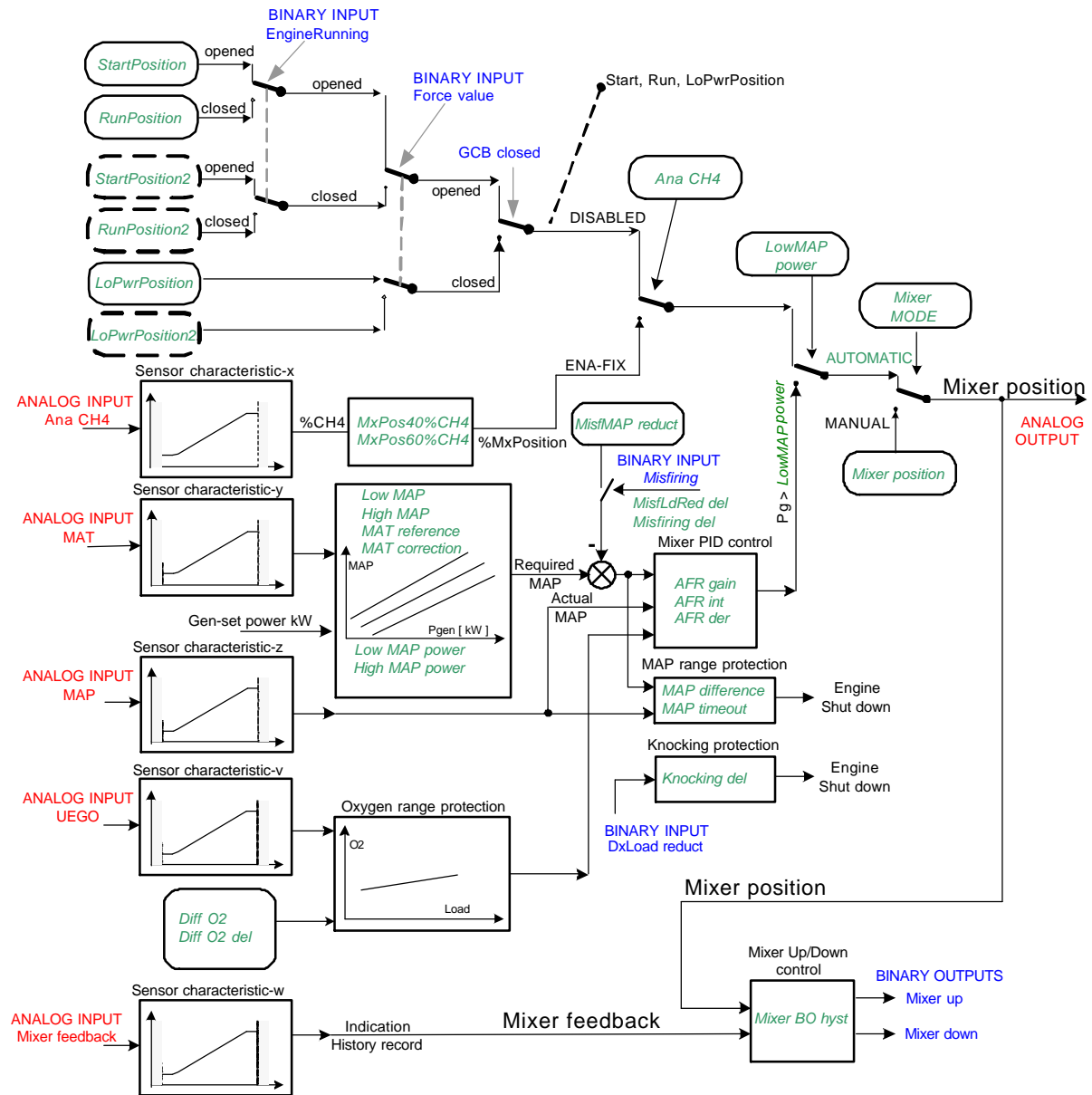
Number of kWh per one 1 sec pulse on Logical binary output "kWh pulse". Pulse calculation starts from setpoint change.

Step: 1 kWh

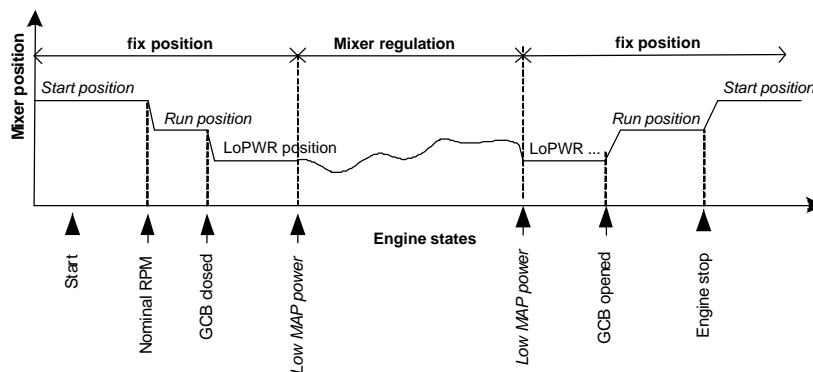
Range: 0 to 65535 kWh

AFR control chart

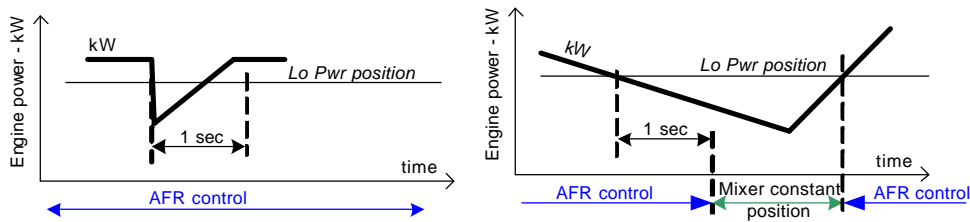
... corresponds to software version 1.5



Timing chart



AFR control stays active during short (up to 1 sec) engine power drop out (no jump to *LoPwr position*).



Protections

MAP control fail

Engine shut down is detected and Binary output "MAP ctrl fail" is closed when actual MAP value is out of range. See setpoints **AFR control**: *MAP difference*, *MAP timeout*. Protection is active when genset power > *Low MAP power*.

MAT sensor fail

Engine Slow stop (Cool down) is activated when MAT sensor fail is detected.

Misfiring

External Misfiring detection unit output must be connected to IntelliSys binary input Misfiring.

Knocking

External Knocking detection unit output must be connected to IntelliSys binary input DxLoad reduct.

Oxygen range

Engine Slow stop (Cool down) is activated when actual O₂ (from UEGO input) is out of range. See Analog input UEGO.

Hint:

MAP control fail, Misfiring, Knocking, Oxygen range protections are activated from *Low MAP power*.

Active Sprinkler function blocks engine stop due to MAP control fail, Misfiring, Knocking and Oxygen protection - engine stays running even if any from those protections is active.

Sprinkler protection does not block MAP and MAT sensor fail detection - engine will stop when MAP or MAT sensor fail is detected, even if BI Sprinkler is active.

Not configured MAP or MAT analog input indicates sensor fail alarm.

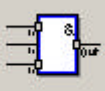
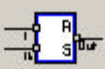
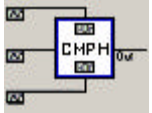
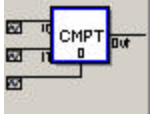
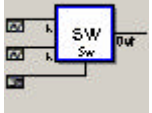
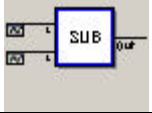

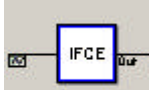
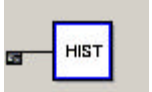
Gas Valve test procedure

Test is based on the external automatic unit that put pressure between two closed Gas valves and measures pressure value stability. Test is activated prior to engine start by IntelliSys Binary output GasVTest run. IntelliSys waits for adjustable delay for test result - Binary input GasVTest OK must be closed within this time. Engine starts at any time during Gas valve test procedure when Binary input GasVTest OK is closed. Engine shut down is detected (Sd GasVTest message in AL and HST) when no positive feedback (GasVTest OK) is received during adjustable delay *GasVTest del*. Gas Valve TEST procedure is skipped during Automatic Mains Fail gen-set start to short black-out time.

History and Alarm list records

Record	Reason
MAPControlFIs	MAP or MAT not configured or sensor fail
Stp O2 limit	O2 is out of range when gen-set power > <i>Low MAP power</i>
Sd MAPCtrlFail	MAP is out of range during active AFR control
Wrn Misfire	Active BI Misfiring
Sd Misfire	Misfiring protection was active 6x in one hour
Sd MisfireTO	After <i>Misfiring timeout</i>
Wrn Knocking	Active BI Knocking
Sd KnockingTO	After <i>Knocking timeout</i>
Sd Knocking	Knocking protection was active 6x in one hour
Sd GasVTest	Gas valve test shut down
Dongle incomp	Corresponding AFR dongle is missing

Number of programmable functions of IS-NT-AFR branch

Config item	Selection available	IS-NT	Note
	Log Func I.	64	AND, OR 2 to 8 inputs Binary output
	Log Func II.	16	XOR, RS (flip-flop) 2 inputs Binary output
	Comp Hyst	16	Analog input Two limits Binary output
	Comp Time	8	Analog input One limit + delay Binary output
	Ana Switch	16	Two analog inputs Analog output Binary input as selector
	Math Func	16	ADD, SUB, ABS, AVG, MAX, MIN Two analog inputs Analog output
	Mov Avg	2	Analog input Analog output Performs averaging (filtering) of the input value with selectable weight and period
	InterpolFunc	2	Linear interpolation Analog input Analog output
	ForceHistory	4	Binary input causes history record when changes from 0 to 1

	ForceProtect	4	Adjustable protection levels, based on PLC evaluation
	PID Ana	4	PID control loop with analog output
	PID Bin	4	PID control loop with binary output
	Counter	4	Edges counter One limit Binary output
	Timer	4	Periodic signal generator Binary output Analog input
	Delay	16	Adjustable rising and falling edge delay
	PID Ana B.	4	PID Analog output jumps to adjustable Bias value when Gate input is active (instead zero as before) and starts from Bias.
	Ext. Math.	8	Math functions with expandable number of inputs up to 8. Selectable: ADD, AVG, MAX, MIN Eight analog inputs, one analog output.
	Comp. Win.	16	Window comparator Analog input, two limits, analog output. Binary output is active when input is within limits.
	Ramp	4	Analog input, analog output. Two setpoints for Ramp-up and down speed (in number of units per second). Enable-Up, Enable-Down: Ena/Disables the ramp.

Tips and tricks

How configure switch between fix starting and running mixer position

Genconfig File: Noname-ant* Name: IS-NT Addr:1 Firmware ver: IS-NT-AFR-1.0T R:1.10.2006 Sw configuration ver: 1.0

File Options Help

Modules I/O Setpoints Commands Protections History User Sensors Languages Translator PLC LDI LAL

Groups	Name	Access Group	Value	Dim	Force Value
ProcessControl	GasVTest	0 OR		DISABLED	
Basic settings	GasVTest del	0 OR		60 s	
Engine params	StartPosition	0 OR		10,0 %	StartPosition1
Engine protect	RunPosition	0 OR		20,0 %	RunPosition 1
Analog protect	LoPwrPosition	0 OR		30,0 %	LoPwrPosition1
Gener protect	MixPos40%CH4	0 OR		40,0 %	
Mains protect	MixPos60%CH4	0 OR		60,0 %	
AMF settings	Ana CH4	0 OR		ENA-STEP	
Sync/Load ctrl	Low MAP power	0 OR		10 kW	
Volt/PF ctrl	High MAP power	0 OR		200 kW	
Force value	Low MAP	0 OR		1,000 bar	
Load shedding	High MAP	0 OR		3,000 bar	
Timer settings	MAT reference	0 OR		30 °C	
Art. load/GMS	MAT correction	0 OR		0,000 bar	
Date/Time	Low O2	0 OR		5,0 %	
AFR control	High O2	0 OR		10,0 %	
	Diff O2	0 OR		5,0 %	

Force value(s)

Alternative values					
No.	Name	Value	Forcing	Log. BI	ID
1	LoPwrPosition1	31,0	31	GasSelection 3	3

Default LoPwrPosition 1 setting

Name of binary input switch Renamed from Force value 1

Renamed Force value 3

Com. objects	
Name	Select
Setpoints	
ProcessControl	
Basic settings	
Engine params	
Engine protect	
Analog protect	
Gener protect	
Mains protect	
AMF settings	
Sync/Load ctrl	
Volt/PF ctrl	
Force value	
StartPosition1	<input type="checkbox"/>
RunPosition 1	<input type="checkbox"/>
LoPwrPosition1	<input checked="" type="checkbox"/>
Force value 4	<input type="checkbox"/>
Force value 5	<input type="checkbox"/>

How to measure running time of independent device (e.g.) cooling pump

Use PLC function Timer as minute marks time base:

- Connect Binary input "Run" to measured signal (e.g. cooling pump output).
- Analog input reload set to constant value 300 (i.e. period 1 minute).
- PLC Timer output connect internally to Logical Binary input: Pulse counter 1

Abbreviation list

AMF	Auto Mains Failure (controller starts automatically on mains failure)
AI	Analog Input
AO	Analog Output
ATS	Automatic Transfer Switch (switches the load to actually supplied bus (by mains or generators))
AVR	Automatic Voltage Regulator
BI	Binary Input
BO	Binary Output
BOC	Breaker Open & Cool-down - protection type (see application manual for details)
BTB	Bus-Tie Breaker
CAN1	CAN bus for extension modules connection (e.g. IGS-PTM, IS-BIN8/16, IS-AIN8, I-AOUT8, I-CB, IGL-RA15)
CAN2	CAN bus for intercontroller communication (in multiple applications) and monitoring (connection of I-LB, IG-IB)
COX	Application for Complex Systems where actions are taken by a PLC and the controller only follows the orders => needs an external driver (cox)
ESF	Engine Specific File
FMI	Failure Mode Identifier
GC	Graphical Characters - option for additional support of one "graphical" language
GCB	Generator Circuit Breaker
CHP	Combined Heat & Power - cogeneration application, usually with gas engine
I-AOUT8	Extension module with 8 AO
I-CB	Communication Bridge - interfaces IS, IG/IS-NT, ID controllers and non-standard engine ECU
IG-AVRi	IG Automatic Voltage Regulator interface
IG-EE	InteliGen for Electronic Engines (HW optimized for connection to an engine equipped with ECU)
IG-EEC	InteliGen EE controller with extended communication possibilities + switchable sensing ranges of AC voltages and currents
IG-IB	IG Internet Bridge - for internet/ethernet communication
IGL-RA15	Indication panel with LEDs signaling state of 15 BO
IG-NT	InteliGen New Technology gen-set controller
IG-NTC	InteliGen NT controller with extended communication possibilities + switchable sensing ranges of AC voltages and currents
IGS-NT-LSM+PMS	Dongle for IG-XX and IS-NT to enable Load Sharing control loops and PMS
IGS-PTM	Extension module with 8 BI/BO, 4 AI and 1 AO
I-LB	Local Bridge – for direct and modem monitoring and control of multiple gen-sets
IM-NT	InteliMains New Technology - Mains supervision controller; the same controller in a different SW configuration can work as a bus-tie synchronizer
I-RB	Relay Board
IS-AIN8	Extension module with 8 AI.
IS-BIN8/16	Extension module with 8 BO and 16 BI.
IS-NT	InteliSys New technology gen-set controller
IS-NT-BB	InteliSys New Technology Basic Box (without display)
KWP2000	Key Word Protocol of Scania S6 unit (for engine diagnostics)
LS	Load Sharing - analog load sharing line to interconnect the gen-sets on the site (for isolated parallel or mains parallel of multiple gen-sets); IG/IS-NT controllers use digital Load Sharing via

	CAN2 bus
LSM	Load Sharing Module
LT	Option for Low Temperature modification (display equipped with heating foil)
MCB	Mains Circuit Breaker
MGCB	Master Generator Circuit Breaker (sometimes used with multiple gen-sets in island parallel or mains parallel operation)
MINT	Multiple application with INTERNAL control loops - for multiple gen-sets in island parallel or mains parallel operation; Load Sharing and VAR Sharing controlled internally; PMS available
MP	Mains protection
NPU	Mains protection relay (voltage, frequency, vector shift protections)
OC	Occurrence Count (number of fault occurrences transmitted in diagnostic frame from ECU)
OfL	Off load - protection type (see application manual for details)
PGN	Parameter Group Number (refer to SAE J1939-71)
PMS	Power Management System - ensures optimization of running gen-sets on the site with multiple gen-sets; based on kW/kVA spinning reserve or on relative (%) load; no-master system ensures high reliability
SHAIN	Shared (virtual) Analog INput module
SHAOUT	Shared (virtual) Analog OUTput module
SHBIN	SHared (virtual) Binary INput module
SHBOUT	SHared (virtual) Binary OUTput module
SPI	Single Parallel Island application - for single gen-sets in parallel with mains or in island operation; suitable for CHP application; no MCB control
SPM	Single Prime Mover application - for single gen-sets without mains
SPN	Suspect Parameter Number (refer to SAE J1939-71)
SPtM	Single Parallel to Mains application - for single gen-sets in parallel with mains or in island operation, with AMF support; both MCB and GCB controlled
SSB	Single Stand-By application - for single gen-sets with mains and break transfer gen-set to mains
VPIO	Virtual periphery I/O module – internal “SW wires” linking binary outputs to inputs
VS	VAR Sharing - ensures VAR sharing between the gen-sets on the site via CAN bus (for isolated parallel or mains parallel of multiple gen-sets)