CuteLine
Gas Mixer Control AF1500P

Manual

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HUEGLI TECH Switzerland

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Revision History

The changes and additions are added here every time a new revision of the document is made.

Rev	Description	Date	Author
0.1	Preliminary Version	15.07.2015	IF
1.2	MiniMix new Version added	01.07.2016	IF
1.3	Hard- and Software modification implemented	26.01.2017	IF
1.4	Corrected minor mistakes	21.10.2020	JM

Approved:

	Author	R & D	
Date & Initials	*15.07.2015* ***IF***	*15.07.2015* ***SA***	

Table of Contents

1 Installation declaration (for an incomplete machine)

Installation declaration

(Directive 2006/42/EC, Appendix II B)

The manufacturer: Huegli Tech AG, Murgenthalstrasse 30, 4900 Langenthal, Switzerland

hereby declares that the incomplete machinery:

*General description:***HT-CL-AF1500P**

complies with the basic health and safety requirements of machinery directive 2006/42/EC Appendix I.

The special technical documents in compliance with Appendix VII part B have been produced.

The incomplete machine corresponds with the following other EC directives:

Low tension directive 2006/95/EC

The following harmonised norms were applied:

DIN EN ISO 12100:2011 **(consolidation of EN ISO 12100-1; EN ISO 12100-2; EN ISO 14121-1)**

Authorised representative for creation of the technical documents:

U. Moser Murgenthalstrasse 30 4900 Langenthal

The special technical documents are transmitted in electronic form as required by individual state offices.

Operating the incomplete machine is not permitted until the incomplete machine is built into a machine that conforms to the provisions of the machinery directive and an EC conformity declaration in compliance with Appendix II A is provided.

Langenthal 16.07.2015 Huegli Tech AG,

2 About this document

2.1 Information about the Manual

2.1.1 Purpose

The purpose of this manual is to aid in the installation and operation of the AF 1500P. This manual and its context assumes that the reader has a high level of expertise on the operation of combustion engines and basic understanding of electronic control systems.
DO NOT attempt to install this piece of equipment without reading and understanding this manual.

2.1.2 Contents

This Manual contain important details and information about the CuteLine AF1500P Module

2.1.3 Product affiliation

The Manual describes the finished product at the time of initial delivery.
Supplementary to this manual, there are no special contractual agreements and technical documents needed or available.

2.1.4 This Manual is an integral part of the product

- To ensure trouble-free and safe operation as well as the settlement of any warranty claims, always read this manual first and observe all the information contained herein.
- Keep these Manual close to the product
- Always give the Manual to each subsequent owner or user. Huegli Tech shall not accept liability for any damages or malfunctioning caused by non-adherence to this Manual.
- Please contact Huegli Tech Customer Service if you have any further questions after reading these operating instructions.

2.2 Warning signs in this document

The warning signs in this document provide information about dangers which may arise during product operation. The relevant warning signs are displayed in the “safety” section and at the beginning of each chapter.

There are 3 types of warning signs:

Signal word	Meaning	Consequences of non-adherence
DANGER	Warns of imminent danger	If not avoided will result in death or serious injury.
WARNING	Warns of a possible danger	If not avoided could result in death or serious injury.
CAUTION	Warns of a possibly dangerous situation	If not avoided could result in minor or moderate injury.

2.2.1 Warning sign design

DANGER

The type and source of the imminent danger is specified here!

Possible consequences of non-adherence are stated here.

➢ Protective measures against the danger are listed here

➢ Always read and carefully observe all warning signs.

2.3 Other symbols

NOTICE

The sign specifies possible property damages

➢ Protective measures against property damages are listed here.

This symbol displays safety instructions

This symbol displays useful and important information.

➢ This symbol refers to an actual task.

3 Safety

3.1 Basic Safety Instructions

⚠ WARNING

Some of the CuteLine functions are subjected to changes depending on SW version.
The data in this manual only describes the product and are not warranty of performance or characteristic.

NOTICE

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

⚠ CAUTION

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

All parameters are pre-adjusted to their typical values. But the set points in the "**Basic settings**" settings group **!!must!!** be adjusted before the first start-up 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!!!

4 General Guidelines

4.1 Introduction

The **HT-CL-AF1500P** is a Mixer Driver Module which is optimized for use with Huegli Tech Gas Mixer RM814, RM25, RM40 and MiniMix.
This device performs either as a single or dual stepper motor control depending on the mixer type selected for use.

4.2 Safety instructions and Warnings

Before installing and starting the device, please read the operating instructions. These contain important notes for safety and use.
No liability can be accepted for damage arising from failure to follow the instructions or any inappropriate use.
The HT-CL-AF1500P unit may only be used for the manner of operation prescribed in the operating instructions and only in connection with third-party devices and components recommended or installed by us or software supplied by us. Any other use shall be considered inappropriate use and will result in the voiding of all liability and warranty claims against the manufacturer.

Interventions and alterations that influence the safety technology and the functionality of the Mixer module may be carried out only by the manufacturer.

Fault-free and safe operation is conditional upon competent transport, assembly and installation as well as qualified use and correct maintenance.

All relevant accident prevention regulations and other generally recognized technical safety and health and safety at work rules are to be observed. Fault-free functioning of the machinery and its peripheral components is only guaranteed with original accessory parts and spare parts.
The HT-CL-AF1500P unit is robust enough to be placed in a control cabinet with other operating control devices.

4.3 Guarantee terms and conditions

4.3.1 Correct use

The device is intended for exclusive use under the conditions described in the "Technical Data" rubric. Other uses are potentially dangerous. Huegli-Tech AG cannot accept liability for damage which results from incorrect use or application other than that for which it was intended.

4.3.2 Use of Accessories

Accessory parts may be installed or added only when they have been explicitly authorized by Huegli Tech AG. Any claims under guarantee, warranty or product liability shall be void if other parts are used.

The general guarantee terms and conditions of Huegli Tech AG shall apply.

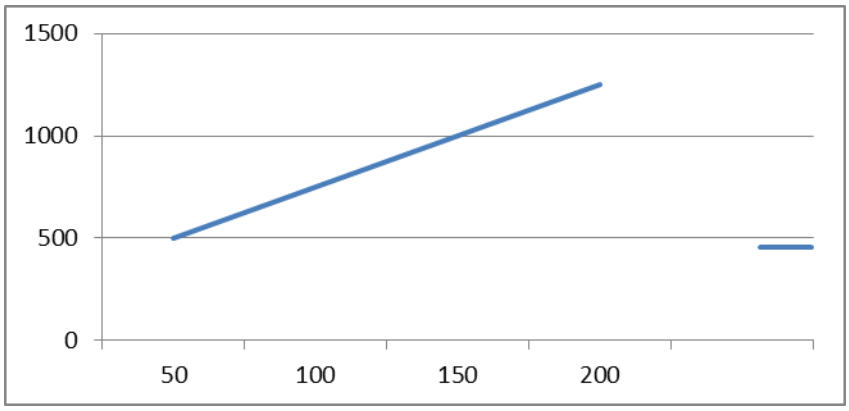
5 Function Description

Basically, Turbocharger pressure is called boost pressure. The boost pressure based Lambda control uses the current load of the engine and the actual boost pressure. Therefore it can only be used for turbo charged engines.

There is a linear relation between load and boost pressure depending on the Lambda value. If the mixer is controlled manually to a fixed Lambda value, and when the load is increased, the values of load and boost pressure will raise linear.

These values can look like this :

Load (kW)	Boost Pressure (mbar)
50	500
100	750
150	1000
200	1250



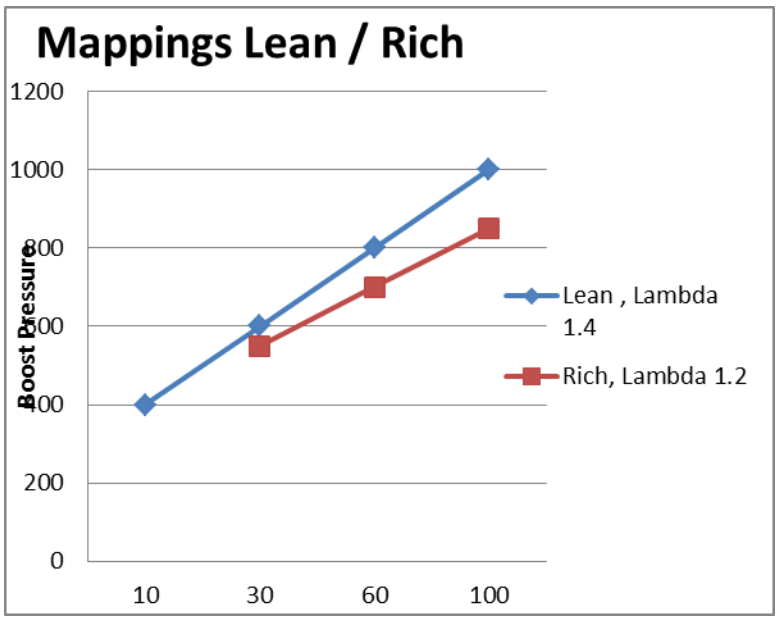
So the controller needs a mapping of load and boost pressure to be configured while commissioning. Once this mapping is set the mixer controls is controlled by the requested boost pressured (which is calculated by the actual load) and the actual boost pressure.

If the requested boost pressure is higher than the actual boost pressure the gas mixture is too rich and the mixer must close.

If the requested boost pressure is lower than the actual boost pressure the gas mixture is too lean and the mixer must open.

The controlling of the mixer signal is done by a PID – loop.

To get more flexibility especially for biogas application a second load / boost pressure mapping is implemented. With this function the engine can run richer in case it's needed because of worse gas quality.



Having two mappings the requested boost pressure can be interpolated between the two curves in the graphic above.

The lean curve always has 4 set points, the rich curve only 3.
The interpolation is done by an external value which determines the requested boost pressure value between the lean and the rich curve.
If the module is in working modes DST 4602 or COMPACT this setting can be done external. In working modes J1939 or STANDALONE the selection can be done only by setting its value in the PC configuration software

The interpolation is done by a value between 0 and 10 where 0 means lean curve and 10 means rich curve. All values in between (1 to 9) calculate the requested boost pressure by interpolation between the two curves.
If that value is set to 0 only the lean curve is used, a rich curve must not be set. In case the value is 11 the PID loop is inactive and the mixer stays in the selected start position. This mode is necessary for calibration and testing.

The set points for the lean curve must be set as follows :

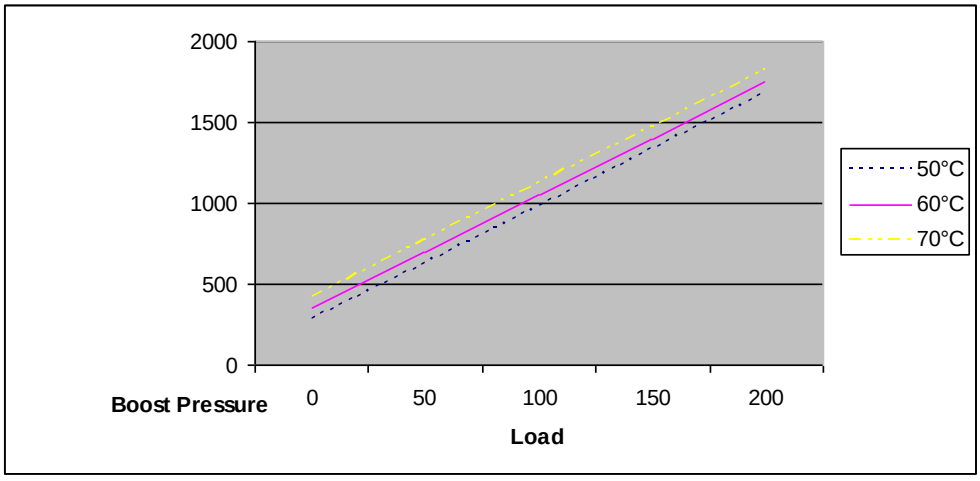
Set Point	Percentage of max. Load
1	< 10%
2	>= 10% and < 30%
3	>= 30% and < 60%
4	> 60%

The load set points for the rich curve must correspond to the lean curve with a tolerance of +-3% where :
Set Point 2 LEAN = Set Point 1 RICH (+-3 points of Point 2 LEAN)
Set Point 3 LEAN = Set Point 2 RICH (+-3 points of Point 3 LEAN)
Set Point 4 LEAN = Set Point 3 RICH (+-3 points of Point 4 LEAN)

This principle only works if the MAT is constant and has the same temperature value as while setting the mapping. Because this condition can never be fulfilled if a temperature correction must be done. While setting up the mapping, the actual MAT must be set to the corresponding set points.

If the engine is running after the setting are done in automatic mode, and the MAT is different from the MAT set point the requested boost pressure must be corrected.

The rule is :
MAT **higher** than the MAT set point :Requested boost pressure must be shifted **up**
MAT **lower** than the MAT set point :Requested boost pressure must be shifted **down**



6 Installation and connection

6.1 Mounting

The CuteLine modules are designed to be mounted on a 35 mm DIN Rail and can be easily attached and detached from the DIN rail.

To mount the module on the DIN rail, attached the upper portion of the module onto the DIN rail and press down the module until the hook clicks itself.
To remove the module from the DIN rail, simply unhook the lower part using a screwdriver and lift the enclosure from the DIN rail.

IMPORTANT

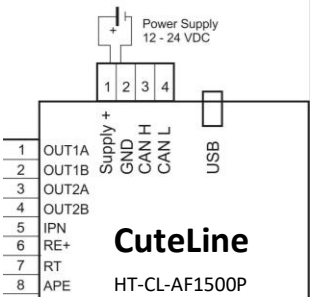
- Use of inappropriate cables may lead to wrong measured values.

6.2 Electrical Connection

All connectors can be pulled out from the board for easier wiring.

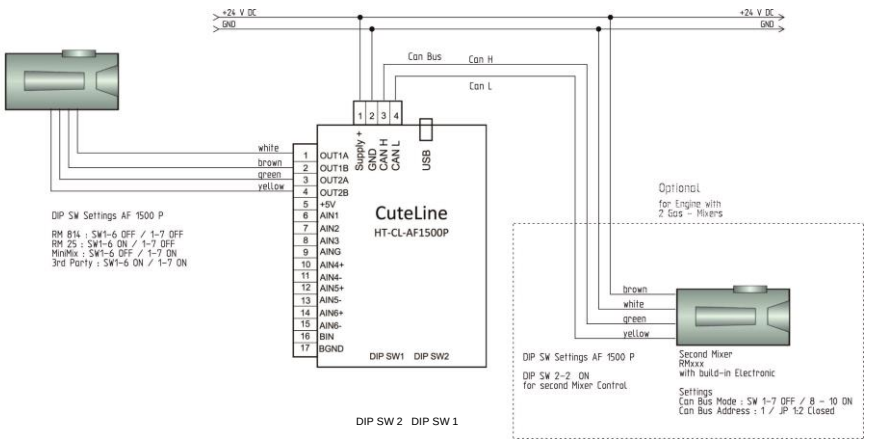
6.3 Power Supply

The nominal supply input for CuteLine AF1500P Module is 24 VDC but it can also work from a voltage range of 7-30VDC. The green LED on the front is turned on when the device is connected to the power supply. The supply input is reverse polarity protected.



6.4 Wiring Mixer

The mixer must be connected according this diagram on the right. The cables of the harnesses should be only connected to the module when the module is switched off.
For special applications on V-engines sometimes it's necessary to use two gas mixers, one for each bank. In

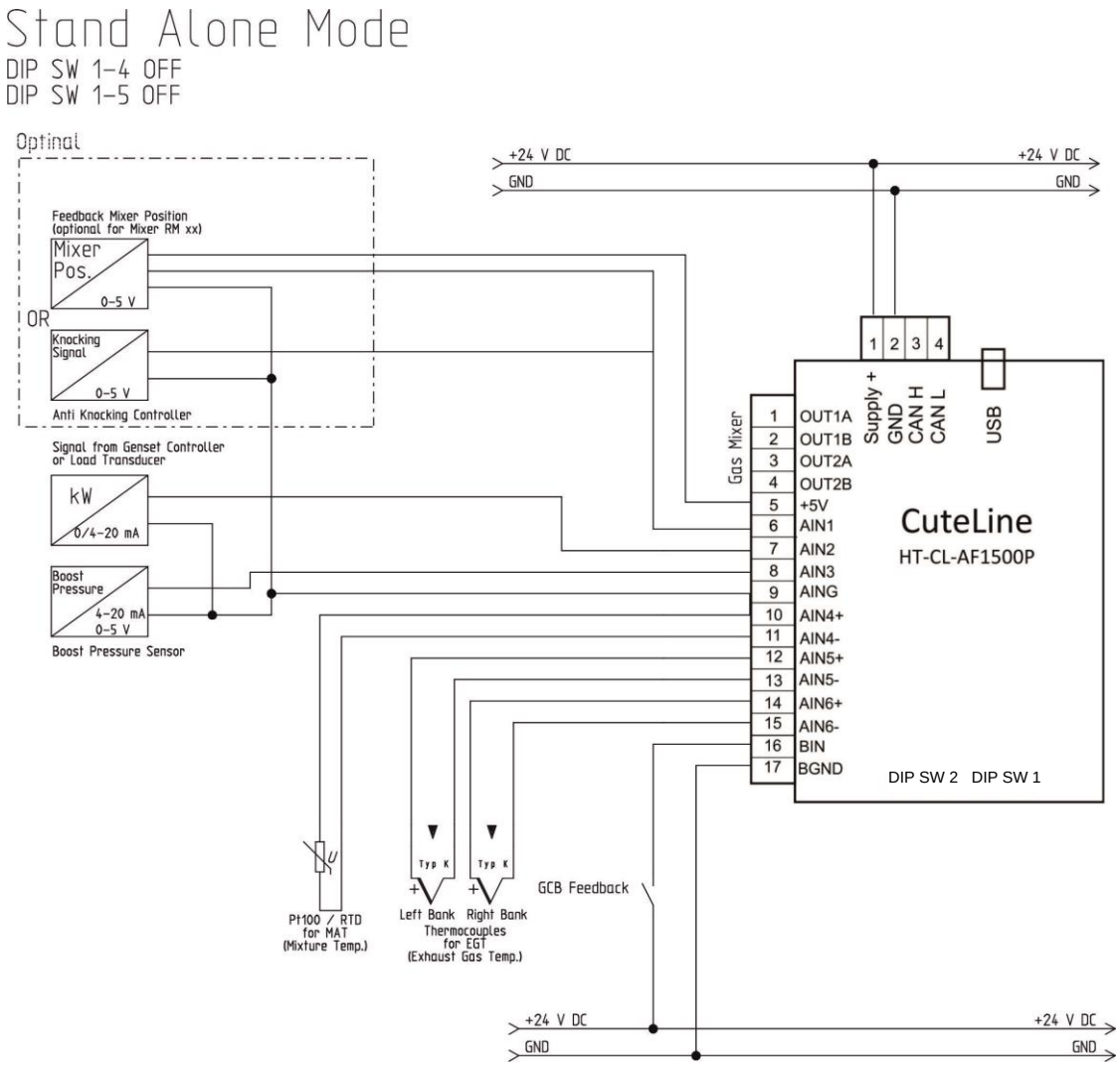


that case one mixer (e.g. Bank A) is connected directly to the AF 1500P, for the other Bank a gas mixer series RM... with build-in is used and connected via Can Bus to the AF 1500P.

6.5 Working Modes

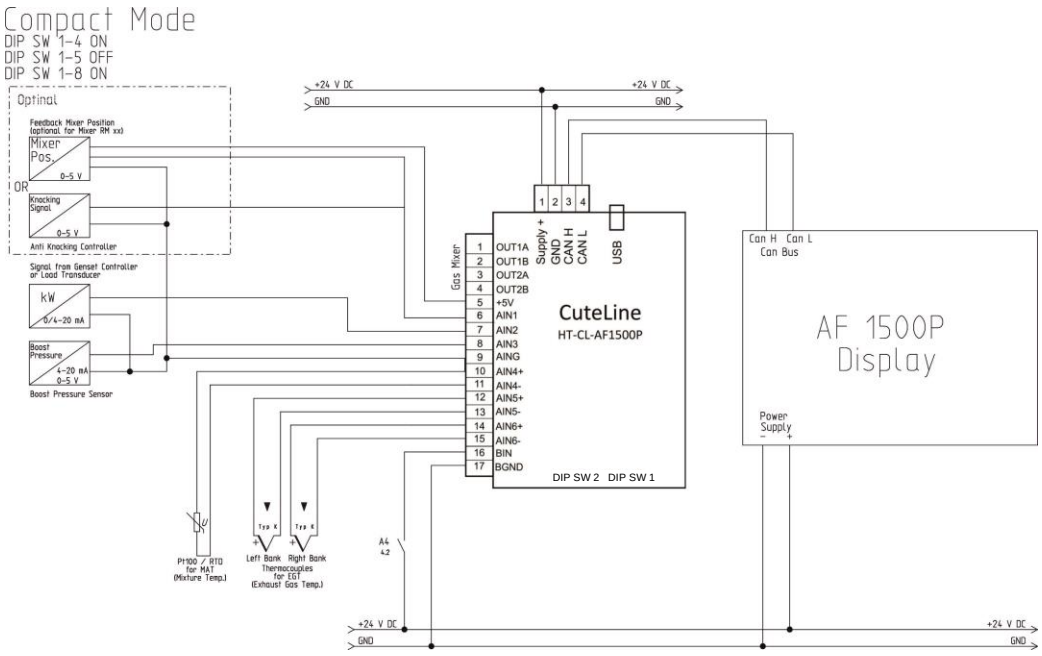
6.5.1 Stand Alone Mode

In Stand Alone Mode the AF 1500P is not connected to any external device by Can Bus. All signals must be connected the device



6.5.2 Compact Mode

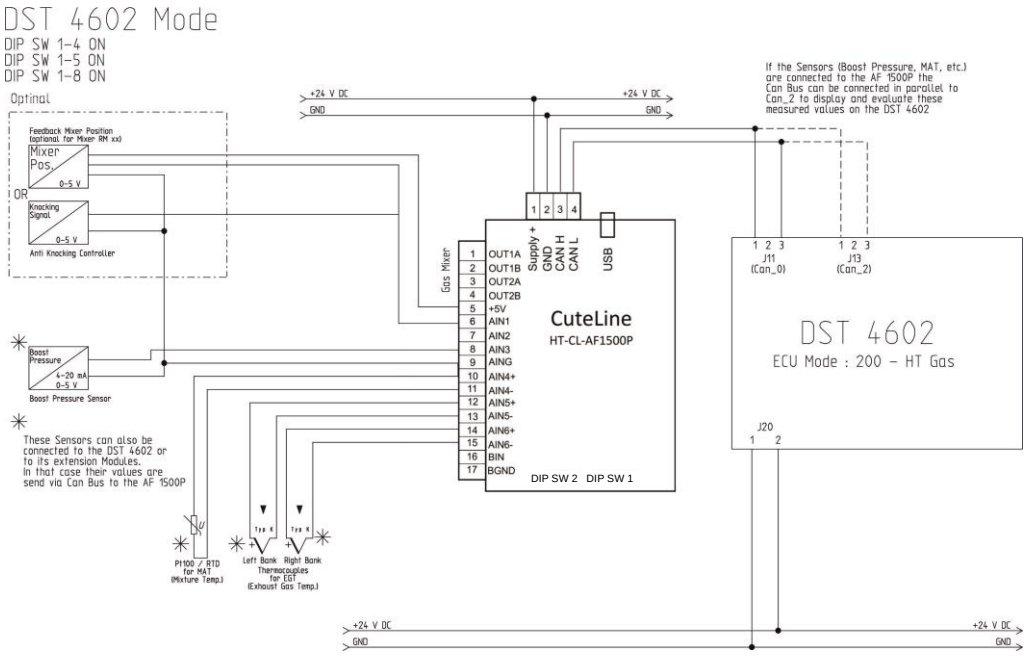
In the Compact Mode all signals must be connected the device. Settings can be done by the external display or by the PC software



The AF 1500P Display shows all measured values and can be used for the setup.

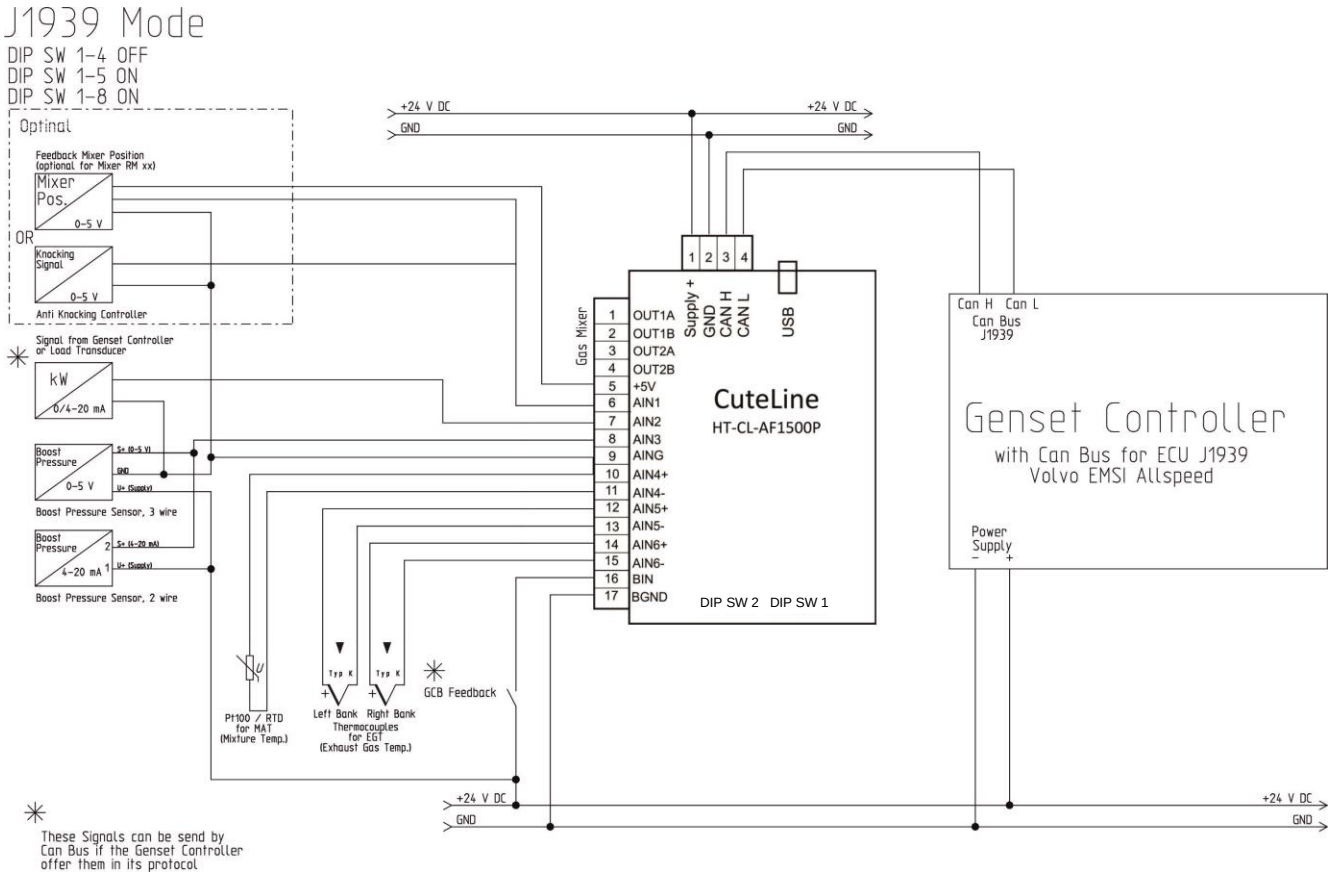
6.5.3 DST 4602 Mode

In this mode the AF 1500P must be connected to a genset controller HT-DST 4602.
Most of the set points for the AF 1500P can be set in the DST 4602.

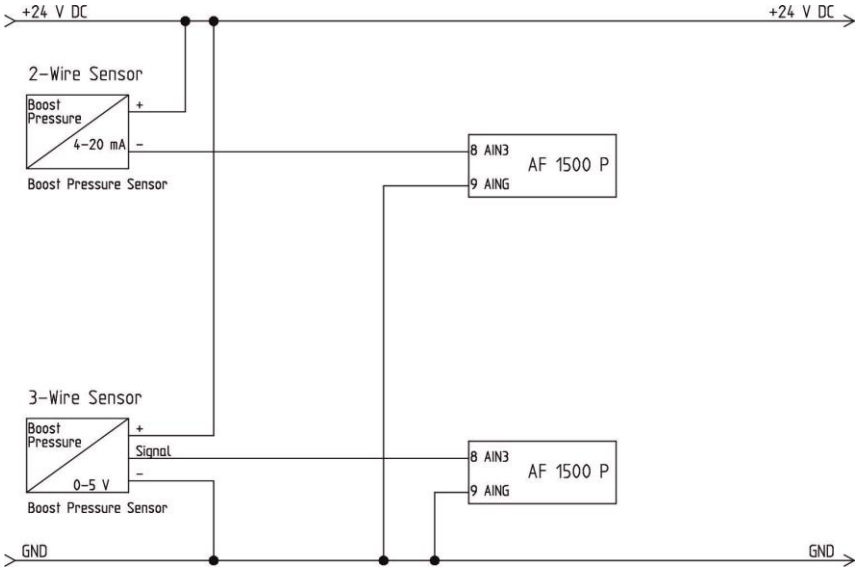


6.5.4 J1939 Mode

In this mode the AF 1500P must be connected to a genset controller which provides Can Bus protocol J1939 for ECU .



6.5.5 Boost Pressure Sensor Connection



6.6 DIP Switch settings

DIP Switch 1

1	2	3	4	5	6	7	8
ExCan Address Setting			Operation Mode		Mixer Type		Termi-nation

ExCan Address Setting (only for DST 4602 Mode)

Address	SW1:1	SW1:2	SW1:3
1	OFF	OFF	OFF
2	**ON**	OFF	OFF
3	OFF	**ON**	OFF
4	**ON**	**ON**	OFF
5	OFF	OFF	**ON**
6	**ON**	OFF	**ON**
7	OFF	**ON**	**ON**
Reserved	**ON**	**ON**	**ON**

Operation Mode Settings

Operation Mode	SW1:4	SW1:5
Stand Alone	OFF	OFF
Compact	**ON**	OFF
J1939	OFF	**ON**
DST 4602	**ON**	**ON**

Gas Mixer Settings

Gas Mixer Type	SW1:6	SW1:7
RM 814	OFF	OFF
RM 25 / 40	**ON**	OFF
MiniMix **Ser.Nr. >=HT1057**	OFF	**ON**
3rd Party	**ON**	**ON**

HINT

Setting for MiniMix with Ser.No <= HT1057

SW 1:6 and SW1:7 ON

Setting in PC Configuration Software

Mixer Revolution Scaling = 1.4 (see chapter 8.1.4)

Can Bus Termination

Termination Resistor	SW1:8
None	OFF
120 Ohms	**ON**

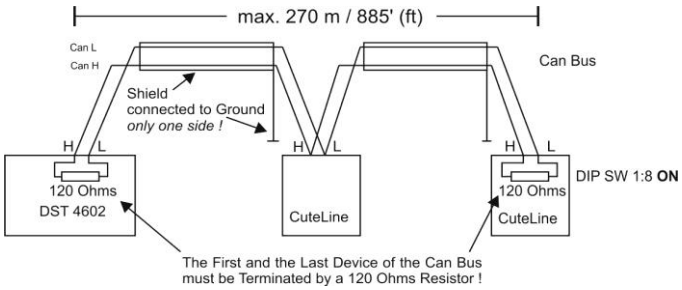
DIP Switch 2

Position	SW 2:1	SW 2:2	SW 2:3	SW 2:4
OFF	unused	Single Mixer	Boost Pressure Sensor 0-5 V / 0-20 mA	Load Signal 0-20 mA
ON	**unused**	**Dual Mixer**	**Boost Pressure Sensor 0-5 V / 4-20 mA**	**Load Signal 4-20 mA**

6.7 CAN Bus Connection

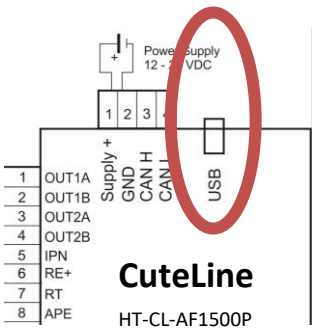
Using the CAN Bus connection, the bus cable must be connected to the terminals Can H(igh) and Can L(ow). If the module is the first or the last device in the bus, a termination resistor is required. There is a built-in resistor (120 Ohms) which can be activated by switching DIP SW1:8 to ON position. Shielded cable (for example, HELUKABEL CAN BUS 2x0.22) must be used for the CAN Bus connection.
If the device is connected to the controller HT-DST 4602 by Can Bus some settings can be done from the controller. Furthermore actual values (Mixer Position, Lambda Value etc.) are displayed on the controller.

Recommended Wiring

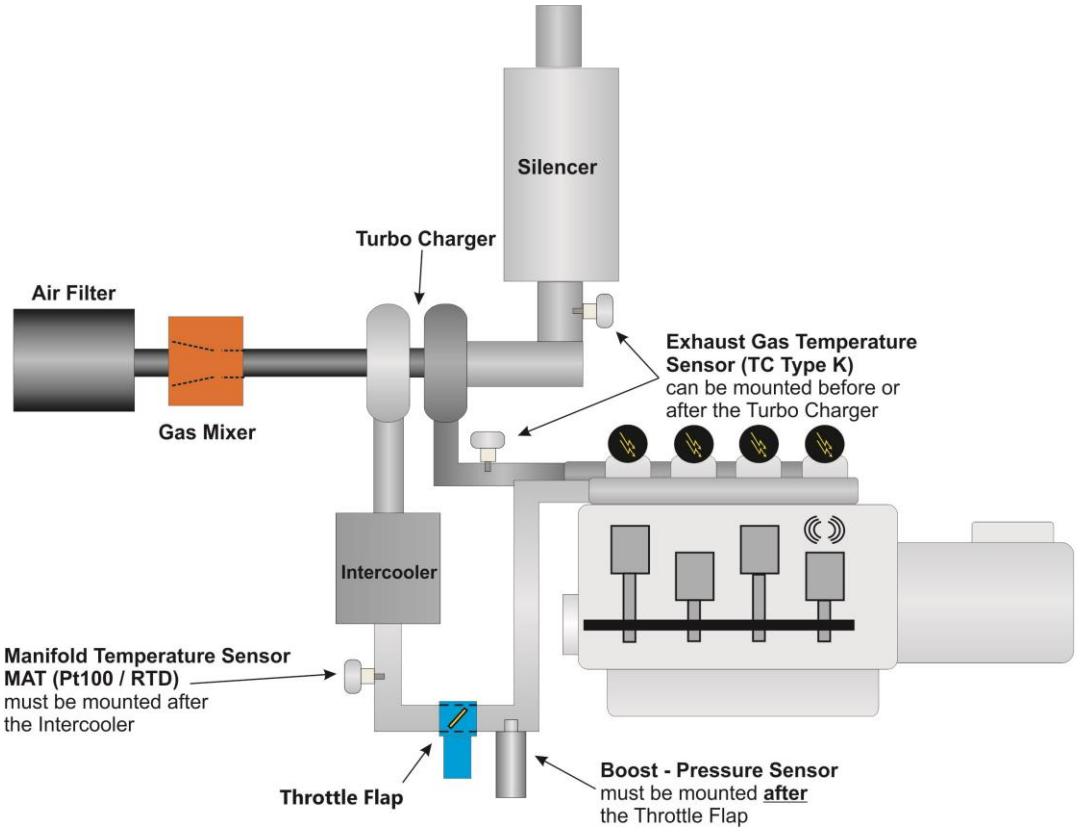


6.8 USB Port

The USB port is used to configure all the settings in the AF1500P Module. This can be done by the AF1500P Setup Software.



6.9 Sensor Mounting

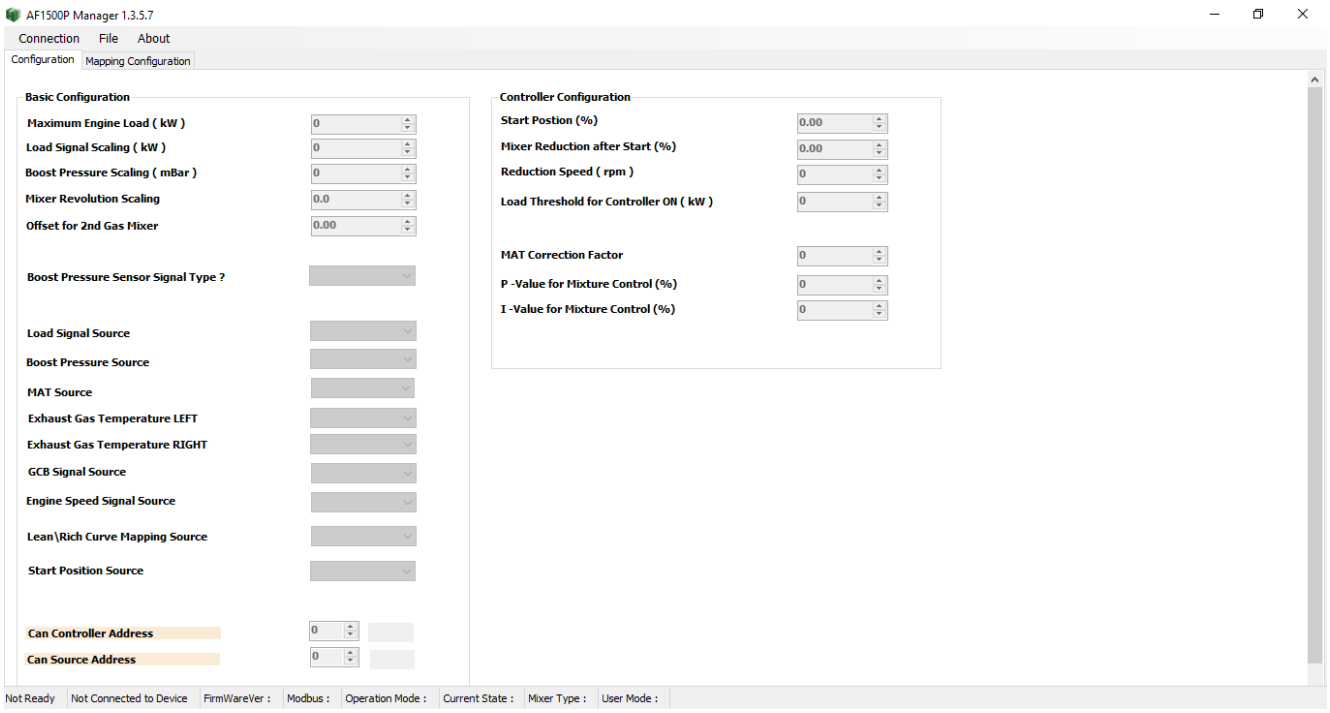


7 PC Software for AF 1500P Configuration

7.1 Installation

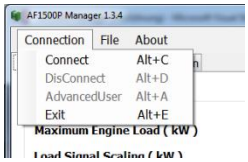
System Requirements Windows XP or Windows 7 32/64 bit

After the AF1500P Setup Software is installed and started, the start screen appears:



7.1.1 Menus

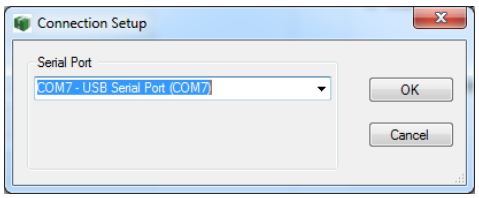
7.1.1.1 Connection



Connect *(Short Cut Key **ALT + C**)*
Click on Connect to connect the PC with the AF 1500P.

HINT
The AF 1500P must be connected with the PC by a USB cable before executing that function !

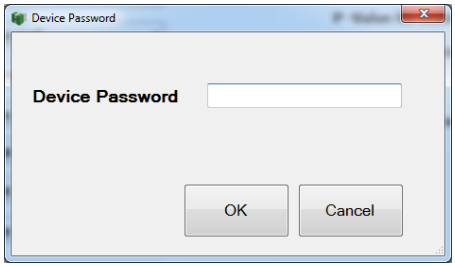
A box with a selection of Com Ports opens :



Use the Com Port which is named COMx - USB Serial Port (COM x) and click on OK

DisConnect *(Short Cut Key **ALT + D**)*
Click on DisConnect to disconnect the PC from the AF 1500P

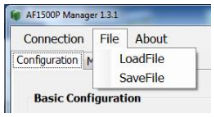
AdvancedUser *(Short Cut Key **ALT + A**)*
Some functions are only accessible by advanced users. These functions are password protected.
This menu is only enabled if the PC is connected to the AF 1500 P !
To get access to these functions click on AdvancedUser and an input box will open :



Type in the password (4900) and click on OK

Exit *(Short Cut Key **ALT + E**)*
Shuts down the program

7.1.1.2 File

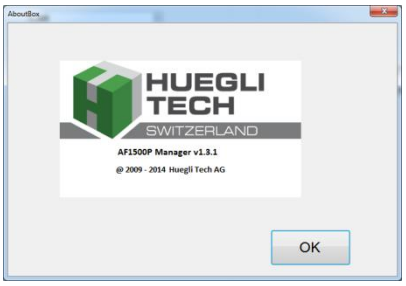


Load File *(Short Cut Key **ALT + L**)*
Loads a configuration into the AF 1500P

Save File *(Short Cut Key **ALT + S**)*
Saves the current configuration of the AF 1500P

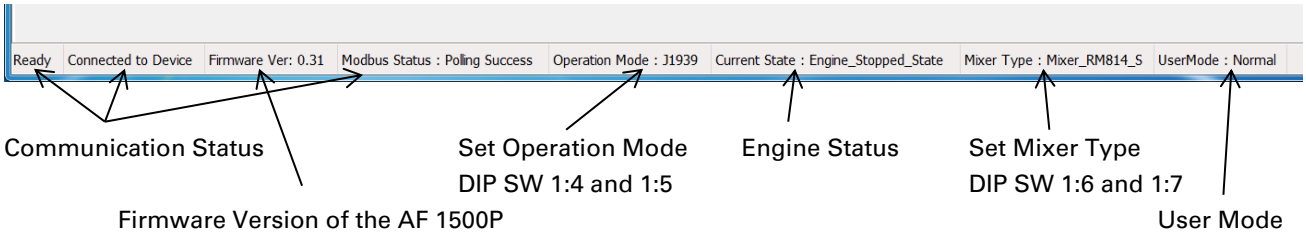
7.1.1.3 About

Shows the current version of the PC Software



7.2 Status Bar

The Status Bar gives information's about the connection status and the setup



8 Set Points

8.1 Basic Configuration

8.1.1 Maximum Engine Load (kW)

Rated Power of the engine. This value is mandatory for the control system

8.1.2 Load Signal Scaling (kW)

This value is related to the value Maximum Engine Load and should be 10% higher than the value of Maximum Engine Load.
If for example the rated power of the engine is 200 kW this value should be 220 kW

8.1.3 Boost Pressure Scaling (mbar)

Measuring range of the connected Boost Pressure Sensor in mbar (normally 2500 mbar)

8.1.4 Mixer Revolution Scaling

If a 3rd Party Mixer is connected to the AF 1500P (DIP SW 1:6 and 1:7 ON) the number of revolution of the stepper motor must be typed in here.
If the motor of the 3rd Party Mixer needs for example 5 revolutions for going from 0 -100% the value 5 must be typed in here.
For all HUEGLI-TECH mixers this is not necessary because the different mixer type can be set by the DIP switches 1:6 and 1:7

8.1.5 Offset for 2nd Gas Mixer

For special applications on V-engines sometimes it's necessary to use two gas mixers, one for each bank. In that case one mixer (e.g. Bank A) is connected directly to the AF 1500P, for the other Bank a gas mixer series RM... with build-in is used and connected via Can Bus to the AF 1500P.
To balance the two banks an offset (-10 ...+10%) can be set here.

8.1.6 Boost Pressure Sensor Signal Type

If the analogue input for Boost Pressure signal is used the signal type of the connected Sensor depending setting of DIP SW 2:3 must be selected.

DIP SW 2:3 OFF	Sensor with Voltage Output
0 – 5 V Sensor	Select ***0 – 5 / 0 - 20 mA***
1 – 5 V Sensor	Select ***1 – 5 / 4 - 20 mA***

DIP SW 2:3 ON	Sensor with Current Output
0 – 20 mA Sensor	Select ***0 – 5 / 0 - 20 mA***
4 – 20 mA Sensor	Select ***1 – 5 / 4 - 20 mA***

The following chapter describes the selection of the sources of the sensor signals. These signals can be read from the inputs of the AF 1500P or can be received via Can Bus (depending on the configuration).
Some functions are only available in certain operation modes

8.1.7 Load Signal Source *(necessary)*

00: Internal The load signal is connected to AIN 2 (terminal 7 of the AF 1500P). This can be a 0-20 mA signal (DIP-SW 2:4 OFF) or a 4-20 mA signal (DIP-SW 2:4 ON)

11: Can Bus The load signal is send from a genset from controller via Can Bus. This function is on available in the operation modes DST 4602 (DIP SW 1:4 and 1:5 ON) and J1939 (DIP SW 1:4 OFF, 1:5 ON).

8.1.8 Boost Pressure Source *(necessary)*

00: Internal The Boost Pressure Sensor is connected to AIN 3 (terminal 8 of the AF 1500P). This can be a 0-5 V signal (DIP-SW 2:3 OFF) or a 4-20 mA signal (DIP-SW 2:3 ON)

11: Can Bus The Boost Pressure signal is send from a genset from controller via Can Bus. This function is only available in the operation mode DST 4602 (DIP SW 1:4 and 1:5 ON).

8.1.9 MAT (Manifold Air Temperature) Source *(necessary)*

00: Internal A Pt100 (RTD) is mounted after the intercooler and connected to AIN4+ and AIN4- (terminals 10 +11 of the AF 1500P).

11: Can Bus The MAT signal is send from a genset from controller via Can Bus. This function is on available in the operation mode DST 4602 (DIP SW 1:4 and 1:5 ON).

8.1.10 Exhaust Gas Temperature LEFT *(optional)*

00: Internal A Thermocouple (Type K) is mounted before or after the turbo charger and connected to AIN5+ and AIN5- (terminals 12 +13 of the AF 1500P).

11: Can Bus The MAT signal is send from a genset from controller via Can Bus. This function is on available in the operation mode DST 4602 (DIP SW 1:4 and 1:5 ON).

01: None No sensor connected or signal from Can Bus not available.

8.1.11 Exhaust Gas Temperature RIGHT *(optional)*

00: Internal A Thermocouple (Type K) is mounted before or after the turbo charger and connected to AIN6+ and AIN6- (terminals 14 +15 of the AF 1500P).

11: Can Bus The MAT signal is send from a genset from controller via Can Bus. This function is only available in the operation mode DST 4602 (DIP SW 1:4 and 1:5 ON).

01: None No sensor connected or signal from Can Bus not available.

8.1.12 GCB Signal Source *(necessary)*

A feedback signal from the GCB is necessary to switch on the emission controller once the engine under load. There are three ways to evaluate that signal :

00: Internal A feedback signal from the GCB connected to BIN (terminals 16 of the AF 1500P).

11: Can Bus The GCB feedback signal is send from a genset from controller via Can Bus. This function is only available in the operation modes DST 4602 (DIP SW 1:4 and 1:5 ON) and J1939 (DIP SW 1:4 OFF, 1:5 ON).

10: Load Only If there is no feedback signal from the GCB available or the controller should be switched on at a certain load this function must be set. The point when the controller is switched on is related to the set point *Load Threshold for Controller (kW)* (see 8.2.4)

8.1.13 Engine Speed Signal Source *(optional)*

The speed signal can be used to detect if the engine is running and can activate the function *Reduction after Start* (see 8.2.2)

01: None Speed Signal not available

11: Can Bus The speed signal is send from a genset from controller via Can Bus. This function is on available in the operation mode DST 4602 (DIP SW 1:4 and 1:5 ON).

8.1.14 Lean / Rich Curve Mapping Source

The AF 1500P provides two mappings for the emission control, a lean and a rich curve.
Here can be selected if the selection is done Internal by the set point *Lambda Selection* (see Chapter 9) or by Can Bus

10: Internal Internal selection by the set point Lambda Selection.

11: Can Bus The Lambda Selection signal is send from a genset from controller via Can Bus. This function is only available in the operation modes DST 4602 (DIP SW 1:4 and 1:5 ON) and COMPACT (DIP SW 1:4 ON, 1:5 OFF).

8.1.15 Start Position Source

In all working modes except STANDALONE it can be selected if the Start Position is received by Can Bus or set internal by the PC software.

10: Internal Internal selection by the set point *Start Position Normal (%)* (see 8.2.1).

11: Can Bus The Start Position value is send from a genset from controller via Can Bus. This function is only available in the operation modes DST 4602 (DIP SW 1:4 and 1:5 ON), J1939 (DIP SW 1:4 OFF, 1:5 ON) and COMPACT (DIP SW 1:4 ON, 1:5 OFF).

8.2 Controller Configuration

8.2.1 Start Position Normal (%) *Range 0.0 – 100.0 %*

Sets the position of the Gas Mixer for starting the engine.

8.2.2 Mixer Reduction after Start (%) *Range -30.0 – +30.0 %*

Shifts the Gas Mixer by x% once the engine is running. This function is only available in the working mode J1939 by sending the signal Engine Running or in the working mode DST 4602 by receiving the engine speed.
In that case the reduction is activated on the engine speed is higher than the threshold Reduction Speed.
A positive Value closes the Mixer, a negative opens it.
Example

Start Position = 45 %
Mixer Reduction after Start = 10 %
Mixer moves from 45 to 35 %

Start Position = 45 %
Mixer Reduction after Start = -15 %
Mixer moves from 45 to 60 %

Hint :
If the result of this function (Start Position + Mixer Reduction after Start) is > 98 % or < 2 % the function is disabled !

8.2.3 Reduction Speed (RPM)

This set point is related to the function Reduction after Start (%) and sets the speed threshold when the reduction is activated
This function is only available in the operation mode DST 4602 (DIP SW 1:4 and 1:5 ON).

8.2.4 Load Threshold for Controller ON (kW)

If the GCB Signal Source is set to 10: Load Only here the set point for the threshold to activate the controller can be set.

8.2.5 MAT Correction Factor

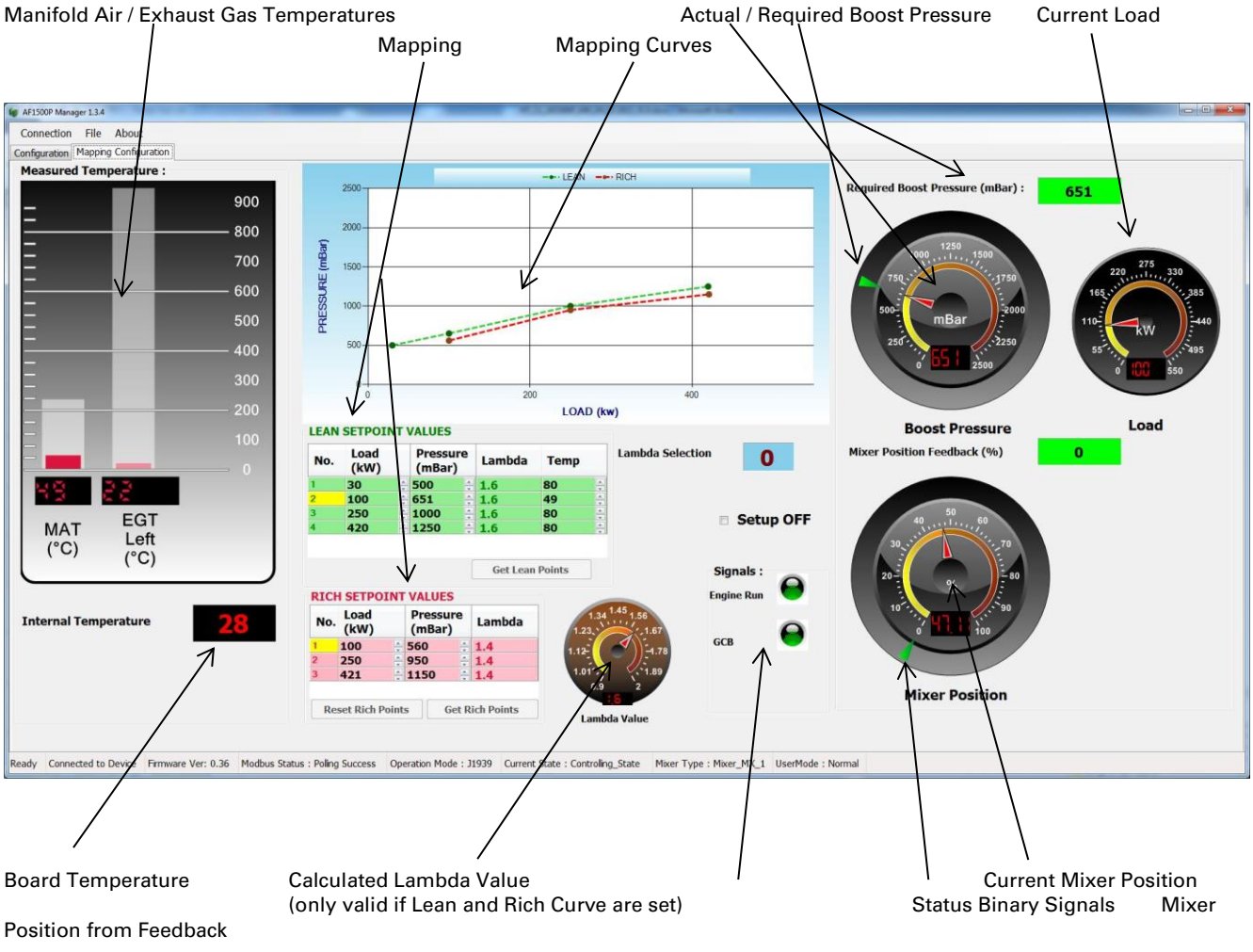
This factor compensates difference between the Manifold temperature while setting up the mapping and current running condition. More details see chapter *Function Description* (see 5)

8.2.6 P- / I- Value for Mixer Control (%)

The P and I values must be set to adjust the response of the control loop when the controller is switched on.

9 Mapping Configuration

This screen is mainly used for setting up the system. Furthermore it can be used to monitor the current values



9.1 Setting Up the Controller

9.1.1 Startup Procedure

To adjust the controller you need an Exhaust Gas Analyzer to measure the Lambda (O_2) value.
Before starting the adjustment procedure the engine must have its normal operation temperature.
Since the controller is not set you must heat up according following steps :

1. Connect the Sensor of the Exhaust Gas Analyzer to the Exhaust Gas Pipe
2. Set the values for *P -Value for Mixture Control (%)* and *I -Value for Mixture Control (%)* to '0'.
   to switch OFF the controller
3. Start the Engine
4. Turn on the measurement of the Exhaust Gas Analyzer
5. Load the engine by closing the GCB, load should be 10 – 20 % of the maximum load
6. Activated the Setup Mode by checking the *Setup...* checkbox. Now the mixer position can be changed manually by using the Up / Down Buttons or by typing in a new position.
   Look on Lambda Value indicated on the Exhaust Gas Analyzer.
   The mixer position can be changed according following rules :
   Lambda / O2 Value too low : close the mixer (direction to 0%)
   Lambda / O2 Value too high : open the mixer (direction to 100%)

7. Now put more load on the engine and look at the Exhaust Gas Values, if necessary correct it by changing the mixer position.
   If the operation temperature has reached unload the engine but keep the GCB closed to start with the …

9.1.2 Adjustment of the controller

For the Rich Curve totally 4, for the Lean Curve totally 3 Set Points are required. If the Lean Curve is not necessary (for e.g. Natural Gas Applications) all of its values can be set to '0' to deactivate it (see 9.2.2)
The rules for the unique set points are according to this :

Lean Curve

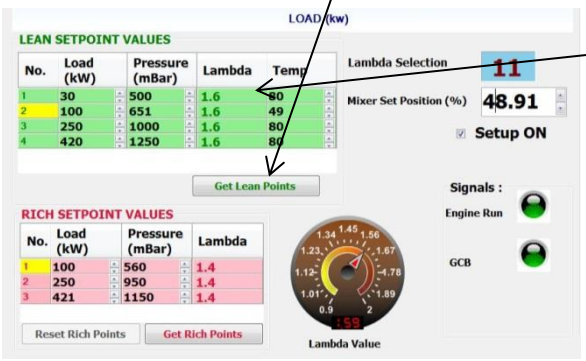
Set Point 1 <10% of the value of the set point *Maximum Engine Load (kW)*
Set Point 2 >=10% and < 30% of the value of the set point *Maximum Engine Load (kW)*
Set Point 3 >=30% and < 60% of the value of the set point *Maximum Engine Load (kW)*
Set Point 4 >60% of the value of the set point *Maximum Engine Load (kW)*

Rich Curve

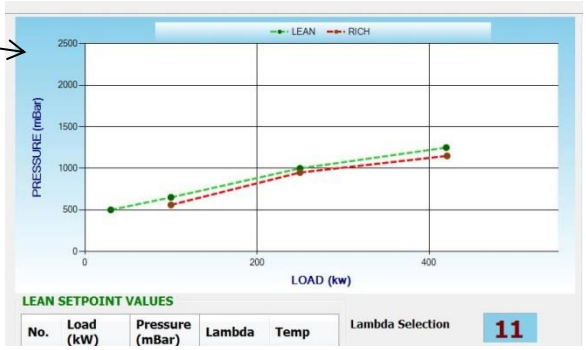
Set Point 1 +- 3 kW of the value of the set point 2 of the *Lean Curve*
Set Point 2 +- 3 kW of the value of the set point 3 of the *Lean Curve*
Set Point 3 +- 3 kW of the value of the set point 4 of the *Lean Curve*

To avoid a wrong setting the software indicates and selects automatic the set point which can be adjusted accord to the current load. The actual possible set point no. has a yellow background,

Starting with the first set point of the Lean Curve you must bring the engine to < 10% of its maximum load. Means for a 500 kW engine the load must be lower than 50 kW.
Now adjust the mixer manually to the required Lambda / O_2 value. If you have reached the target press the button ***Get Lean Points*** to save the currently measured values for that set point.



Type in the current Lambda – Value read from the Exhaust Gas Analyzer into the corresponding cell of the column Lambda and press the Enter key.
Now the first set point is saved and the load must be increased to set the 2nd set point. The procedure is the same as for the first one.
If necessary now the 1st point of the rich curve can be set. Therefore the Lambda / O_2 value must be decreased by opening the mixer. The general rule is that the Boost Pressure of the corresponding set point of the Lean Curve (in this case Set Point 1 of the Lean Curve) must be higher than the one of the Rich Curve.
If you adjusted the mixer to achieve the Lambda / O2 value for that set point press the button Get Rich Points and type in the current Lambda – Value read from the Exhaust Gas Analyzer into the corresponding cell of the column Lambda and press the Enter key.
The following set point must be adjusted with the same procedure. If all the points are set the curve can be seen in the chart above.
The green line shows the lean curve, the red one the Rich Curve.
For a correct setting the green line must be always above the red with all of its set points.



After all setting are done uncheck the check box **Setup**... ,unload the engine and open the GCB and stop the engine.

Now set the values for *P -Value for Mixture Control (%)* (recommended value = 25) and *I -Value for Mixture Control (%)*(recommended value = 30).
Now restart the engine and check if everything is working as expected.

9.2 Special Functions (only for Advanced Users, see 7.1.1.1)

9.2.1 Manual Correction of the Mapping

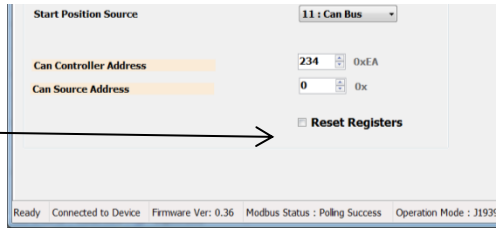
For Advanced Users it is possible to change the set points in the mapping manually by typing in values. Select the cell to modify, type in the value and press the Enter key.

9.2.2 Erasing the Rich Curve

If a both curves are set and the Rich Curve is not needed it can be deactivated by setting all values to '0'. This can be done with the button **Reset Rich Points**.

9.2.3 Setting back the AF 1500P to Factory Setting

An Advanced User can reset the device to Factory setting (Screen *Configuration*) by checking the check box **Reset Register**.



HINT:
All Set Points which were set before will erased !!

10 Technical Data

10.1 Input/output parameters

Supply voltage ..... 7 - 30 VDC, Reverse Polarity Protected
Current Consumption ..... <500 mA with 24 VDC Input @25°C
Number of Inputs ..... 1, Non-Isolated
Number of outputs ..... 1, Non-Isolated
Types of outputs ..... Stepper motor control

10.2 Performance

Sensor Types/Range	Boost Pressure Sensor	Input Current	4-20mA
		Input Voltage	0 – 5V
	Load Signal	Input Current	0-20mA/ 4-20mA
	Exhaust Gas Temperatures M(anifold)A(ir)T(emperature) Pt100 (RTD)		Thermocouple Type K

10.3 Ambient

Operational Temperature ..... -40 to +85°C (-40 to +185°F)
Storage Temperature ..... -40 to +85°C (-40 to +185°F)
Relative Humidity ..... 5 to 95%, Non-condensing
CE certificate EN55011, EN50081-2, EN50082-2, EN61326-1

10.4 Standards / Regulation

Authorizing office ..... CE and RoHS requirements
Communication ..... CAN Bus SAE J1939, Modbus RTU

10.5 Reliability

Calibration ..... Factory Calibrated

10.6 Dimension and weight

Dimensions ..... 139 x 107 x 32 mm
Weight ..... 0.372 kg

10.7 Configuration parameters

Wire Size ..... 0.5 to 4 mm2 (22 to 12 AWG)
Mounting ..... DIN Rail 35 mm