aDDa-R+S/MM

- **4 measurements of heat flow or thermocouple on 24 bits**
- **Selectable number of analogue inputs**
- **0..4 analogue inputs 0-10V or 4-20mA on 10 bits with auto detect**
- **4..0 digital inputs NPN, PNP or floating (active high and low)**
- **6 integrated regulators**
- **4 opto-coupled outputs**
- **Local interface (-R+S-) and sequencer**
- **Extra IO in option**

- o Mathematic functions integrated
- o Fast deployment
- o Parameters storage
- o Cables and jacks included

DESCRIPTION

aDDa-R and **aDDa-MM** modules (aDvanced Data acquisition) integrate functionalities of two aDDa-M-F+T+O modules and one aDDa-M-3A3D module.
aDDa-R version has a local interface built with a 3 lines LCD and 2 buttons. All parameters are settable locally. It completes aDDa-V.
aDDa-R+S module is a mini control process based on heat flow measurements.

PRODUCT SELECTION

Model	Product reference	Interface
145	aDDa-R+S-…	With display and sequencer
146	aDDa-MM-…	Without display

Entries	Product reference	Hardware inputs for thermal measurement			
		Channel 1	Channel 2	Channel 3	Channel 4
22	aDDa-…-FFFF	Heat flow	Heat flow	Heat flow	Heat flow
32	aDDa-…-FTFF	Heat flow	Temperature	Heat flow	Heat flow
42	aDDa-…-FSFF	Heat flow	Sensor	Heat flow	Heat flow
33	aDDa-...-FTFT	Heat flow	Temperature	Heat flow	Temperature
44	aDDa-…-FSFS	Heat flow	Sensor	Heat flow	Sensor
36	aDDa-...-FTTT	Heat flow	Temperature	Temperature	Temperature
46	aDDa-...-FSTT	Heat flow	Sensor	Temperature	Temperature
66	aDDa-…-TTTT	Temperature	Temperature	Temperature	Temperature
77	aDDa-...-RR	Active sensor (R1)		Active sensor (R3)	

Option	Analog or digital input	Digital input and analogue output	Digital input or output
A	4		
B	4	2	2

PRODUCT NUMBER

Model	R+S	145	A	4 inputs	Option
	MM	146	B	8 inputs-outputs	

Entries	FFFF	22
	FTFF	32
	FSFF	42
	FTFT	33
	FSFS	44
	FTTT	36
	FSTT	46
	TTTT	66
	RR	77

SUPPLY AND COMMUNICATION

ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Min	Typ	Max	Units
VCC	Operating voltage	6.2	24	30.8	V_{DC}
I_{in}	Supply current		30		mA

- Protected against reverse voltage

COMMUNICATION

RS485 type, half duplex, with proper protocol.

Symbol	Parameter	Min	Typ	Max	Units
B_{rate}	Transfer data rate		19'200		bps
Address	aDDa-R/MM	0x10	**0x14**	0xEF	

PIN CONFIGURATION FOR USB TYPE A STACKED

Pin	Symbol	Parameter
1	VCC	Power supply
2	D-	RS485 differential communication, negative signal.
3	D+	RS485 differential communication, positive signal.
4	GND	Ground
Screen	Earth	Screen continuity

OPTOCOUPLED OUTPUTS

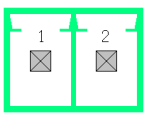
ELECTRICAL CHARACTERISTICS

Open collector type, npn

Symbol	Parameter	Min	Typ	Max	Units
V_{isol}	Breakdown voltage		1500		V_{rms}
V_{CE}	Open collector-emitter voltage			30	V_{DC}
I_C	Collector current		2.4	5	mA
$V_{CE(sat)}$	Closed collector-emitter voltage (I_C = 0.5mA)			1	V_{DC}
t_{LH}	Rise time(VCC = 24V, R_L=10kΩ)		70		µs
t_{HL}	Fall time(VCC = 24V, R_L=10kΩ)		70		µs
f	Output frequency	1.8	50	7k	Hz

PIN CONFIGURATION FOR PHOENIX MC 1,5/2-ST-3.5 (REG1 + REG2)

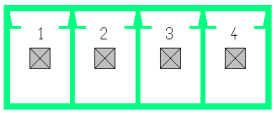
Pin	Symbol	Parameter
1	+	Collector.
2	-	Emitter.



Wire 0.14..1.5 mm^2 (AWG28..16)

PIN CONFIGURATION FOR PHOENIX MC 1,5/4-ST-3.5 (REG3 + REG4)

Pin	Symbol	Parameter
1	Reg3 +	Collector regulator 3
2	Reg3 -	Emitter regulator 3
3	Reg4 +	Collector regulator 4
4	Reg4 -	Emitter regulator 4



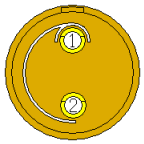
HEAT FLOW INPUT

ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Min	Typ	Max	Units
R_{in}	Differential input resistance	200k			Ω
V_{step}	Resolution		24		bits
$noise_{rms}$	RMS measurement noise		0.2		µV
$noise_{pp}$	Peak to peak measurement noise		1		µV
CMRR	Common Mode Rejection Ratio		100		dB
F_{Sample}	Sample rate	8.3	50		Hz
$A_{in+/-}$	Analogue input voltage	-0.03		5	V
A_{in+}-A_{in-}	Differential input voltage	-2.5		2.5	V
CMA_{in}	Input common voltage		2.5		V

HEAT FLUX CONNECTOR

Pin	Symbol	Parameter
1	F_{in+}	Positive differential input
2	F_{in-}	Negative differential input
Screen	Earth	Screen continuity



THERMOCOUPLE INPUT

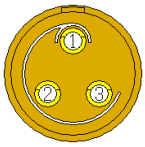
Adapted for J, K or T thermocouple measurement, following ITS-90 norm. Pt100 and Pt1000 could be measured with an adapter.

ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Min	Typ	Max	Units
R_{in}	Differential input resistance	200k			Ω
V_{step}	Resolution		24		bits
$noise_{rms}$	RMS measurement noise		0.2		µV
$noise_{pp}$	Peak to peak measurement noise		1		µV
CMRR	Common Mode Rejection Ratio		100		dB
F_{Sample}	Sample rate	0.5	2.5	8.3	Hz
TC_+TC_-	Analogue input voltage	-0.03		5	V
TC_+-TC_-	Differential input voltage	-2.5		2.5	V
CMA_{in}	Input common voltage		2.5		V
CJC_{Temp}	Cold junction compensation error		0.3		℃

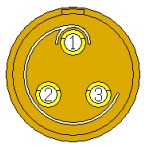
THERMOCOUPLE (3P) CONNECTOR

Pin	Symbol	Parameter
1		Do not use
2	TC_+	Positive thermocouple input
3	TC_-	Negative thermocouple input
Screen	Earth	Screen continuity



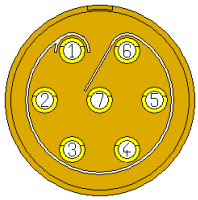
SENSOR CONNECTOR

Pin	Symbol	Parameter
1	HF-	Negative heat flux input
2	Common+	Common positive input
3	TC-	Negative thermocouple input
Screen		Earth
Insulation		



ACTIVE SENSOR CONNECTOR

Pin	Symbol	Parameter
1	CMD	NPN commad, to 0V
2	HF+	Positive heat flux input
3	TC+	Positive thermocouple input
4	TC-	Negative thermocouple input
5	HF-	Negative heat flux input
6	24V	Positive supply
7	0V	Negative supply
Screen		Earth
Insulation		



ANALOGUE OR DIGITAL INPUTS

ANALOGUE INPUTS

Auto detect of input type, 0..10V or 4..20mA. Could be forced in 0..10V, 0..20mA or 4-20mA type..

Electrical characteristics for 0..10V

Symbol	Parameter	Min	Typ	Max	Units
R_{in}	Input resistance		500		k Ω
step	Resolution		10		bits
$noise_{pp}$	Peak to peak measurement noise		20		mV
F_{Sample}	Sample rate	12.5	50		Hz
V_{in}	Analogue input voltage	0		32	V
V_{flot}	Floating input voltage		0		V
V_{err}	Error voltage		12.25		V
GND	Reference voltage		0		V

Electrical characteristics for 4..20mA or 0..20mA, 2 or 3 wires.

Symbol	Parameter	Min	Typ	Max	Units
R_{in}	Input resistance		500		Ω
step	Resolution		10		bits
$noise_{pp}$	Peak to peak measurement noise		40		µA
F_{Sample}	Sample rate		50		Hz
mA_{in}	Analogue input voltage	0		11	V
mA_{err}	High error current (4..20mA and 0..20mA)		24.5		mA
mA_{err}	Low error current (4..20mA)		2.4		mA
GND	Reference voltage		0		V

Gain and offset calibration

Analogue inputs need a calibration of gain and offset to give results in SI units.
The aDDa-M-3A3D module uses this formula:

$$Val[SI]=(Val[V]+Offset[V])*Gain[SI/V]$$

Some examples :

Data sheet			Calculation	Module	
Type	Gain	Offset		Gain	Offset
Pressure	2.5 V/bar	0 bar à 0.5V	$Gain[bar/V]=\frac{1}{Gain[V/bar]}=\frac{1}{2.5}=0.4[bar/V]$ $Offset[V]=-Offset=-0.5[V]$	0.4	-0.5
Temperature	0.4 °C/mV	-50°C à 0V	$Gain[°C/V]=Gain[mV/°C]*1000[mV/V]=0.4*1000=400[°C/V]$ $Offset[V]=\frac{Offset[°C]}{Gain[°C/V]}=\frac{-50}{400}=-0.125[V]$	400	-0.125
Pressure	2.5 mA/bar	0 bar à 4 mA	$Gain[bar/A]=\frac{1}{Gain[mA/bar]*0.001[mA/A]}=\frac{1}{2.5*0.001}=400[bar/A]$ $Offset[A]=-Offset[mA]*0.001[A/mA]=-4*0.001=-0.004[A]$	400	-0.004
Pressure	Scale: 20 bar 200 bar 2000 bar	0V	$Gain[bar/V]=\frac{Scale[bar]}{Range[V]}=\frac{20}{10}=2[bar/V]$ $Gain[bar/V]=\frac{Scale[bar]}{Range[V]}=\frac{200}{10}=20[bar/V]$ $Gain[bar/V]=\frac{Scale[bar]}{Range[V]}=\frac{2000}{10}=200[bar/V]$	2 20 200	0

DIGITAL INPUTS
Electrical characteristics

Symbol	Parameter	Min	Typ	Max	Units
R_{in}	Input resistance		500		k Ω
T_{detect}	Response time		10		ms
V_{flot}	Floating input voltage		6		V
V_{high}	High level detection		12		V
V_{low}	Low level detection		1.2		V
GND	Reference voltage		0		V

DIGITAL INPUT-OUTPUT AND ANALOG OUTPUT

DIGITAL INPUTS
Electrical characteristics for PNP.

Symbol	Parameter	Min	Typ	Max	Units
R_{in}	Input resistance		500		k Ω
T_{detect}	Response time		10		ms
V_{in}	Analogue input voltage	0		32	V
V_{high}	High level detection				V
V_{low}	Low level detection				V
GND	Reference voltage		0		V

ANALOG OUTPUT
Electrical characteristics for 4..20mA.

Symbol	Parameter	Min	Typ	Max	Units
R_{out}	Output impedance		10		Ω
step	Resolution		12		bits
F_{Sample}	Output frequency		20		Hz
V_{out}	Maximum current	0		22.5	V
I_{max}	Maximum current		TDB		mA
GND	Reference voltage		0		V

DIGITAL OUTPUT
Electrical characteristics for PNP.

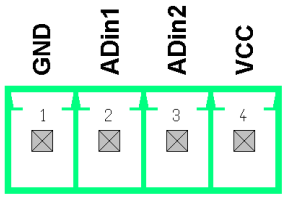
Symbol	Parameter	Min	Typ	Max	Units
R_{out}	Output impedance		10		Ω
F_{Sample}	Output frequency		20		Hz
V_{out}	Maximum current	0		22.5	V
I_{max}	Maximum current				mA
GND	Reference voltage		0		V

OPTION A

PIN CONFIGURATION FOR PHOENIX MC 1,5/8-ST-3.5

Pin	Symbol	Parameter
1	GND	Ground
2	ADin1	Analogue/Digital input 1
3	ADin2	Analogue/Digital input 2
4	24V	Power supply for sensors

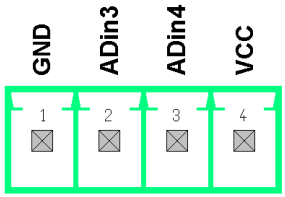
Wires section: 0.14..1.5 mm^2 (AWG28..16)



PIN CONFIGURATION FOR PHOENIX MC 1,5/4-ST-3.5

Pin	Symbol	Parameter
1	GND	Ground
2	Adin3	Analogue/Digital input 3
3	Adin4	Analogue/Digital input 4
4	24V	Power supply for sensors

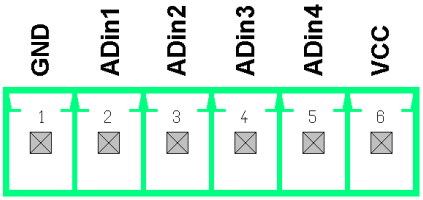
Wires section: 0.14..1.5 mm^2 (AWG28..16)



OPTION B

PIN CONFIGURATION FOR PHOENIX MC 1,5/6-ST-3.55 (ADIN)

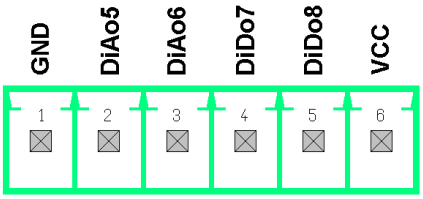
Pin	Symbol	Parameter
1	GND	Ground
2	ADin1	Analogue/Digital input 1
3	ADin2	Analogue/Digital input 2
4	Adin3	Analogue/Digital input 3
5	Adin4	Analogue/Digital input 4
6	VCC	Power supply for sensors



Wires section: 0.14..1.5 mm^2 (AWG28..16)

PIN CONFIGURATION FOR PHOENIX MC 1,5/6-ST-3.5 (DIAO ET DIDO)

Pin	Symbol	Parameter
1	GND	Ground
2	DIAO5	Digital input / Analog output 5
3	DIAO6	Digital input / Analog output 6
4	DIO7	Digitale input/output 7
5	DIO8	Digitale input/output 8
6	VCC	Power supply for sensors



Wires section: 0.14..1.5 mm^2 (AWG28..16)

INTERNAL FUNCTIONS

AUXILIARY MEASUREMENTS

2 other measurements are done in the module:

- Supply input voltage
- Cold junction temperature of thermocouple channels

MATHEMATIC FUNCTIONS

3 mathematic functions are done on heat flow measurements:

- Low-band filter
- Derivate
- Zero function

If a pair of heat flow and thermocouple (channels 1&2 or 3&4) is set in radiant mode (R), the calculated mathematic function will be the target temperature, in stead of filtered, derivate and filtered functions. Each data can be read on the bus.

REGULATORS

6 regulators are implemented in aDDa-R, aDDa-MM and aDDa-R+S modules. They can make internal or external regulation, as explained:

Regulator	Output pin	Output type				
		Internal	Slow (T_0)	PWM	50Hz	60Hz
Reg 1	Opto R1	X	X	X	X	X
Reg 2	Opto R2	X	X	X	X	X
Reg 3	Opto R3		X		X	X
Reg 4	Opto R4		X		X	X
Reg 5	- (R1.1)	X	- (X)		- (X)	- (X)
Reg 6	- (R3.1)	X	- (X)		- (X)	- (X)

They can perform 3 types of functions:

- Constant output
- Digital PID
- Hysteresis regulator

LOCAL INTERFACE (-R-)

Local interface can set-up all module's parameters and display some values during run of the system.

MENU

The navigation in the menus is built on loops, so you can always come back on a parameter by jumping a full loop. To access menu, you have to press both buttons together.
The screen displays your position in the menus. The first line displays the menu were you are, the second line displays the menu possibilities or parameters and the third line displays the parameter value or the measurement value. The left button selects the sub-menu or the parameter; the right button scrolls to the next menu or value.
This is a short view of menu content. Menus written in italic have still sub-menus.

Express	*Sensitivity*	*Filter*	*Regulator*	About	Interface	Exit
Calibrate	*Channel 1*	*Filter 1 and 2*	*Regulator 1*		Language	
Set-point R1	*Channel 2*	*Filter 3 and 4*	*Regulator 2*		Address	
Set-point R2	*Channel 3*	Exit	*Regulator 3*		Rate	
Set-point R3	*Channel 4*		*Regulator 4*		*Panel*	
Set-point R4	Numb Analogue		*Regulator 5*		Exit	
Set-point R5	*AnaDig 1*		*Regulator 6*			
Set-point R6	AnaDig *2*		Exit			
Parameter 1	*AnaDig 3*					
Parameter 2	*AnaDig 4*					
Parameter 3	*DiAo 5*					
Parameter 4	*DiAo 6*					
Exit	*DiDo7*					
	DiDo8					
	Exit					

Parameters in the menu are automatically adapted to sensor or regulator types. Some values have to be selected in lists, other one are floating point numbers (±x.xxxxE±yy = ±x.xxxx $10^{\pm yy}$) or integers.

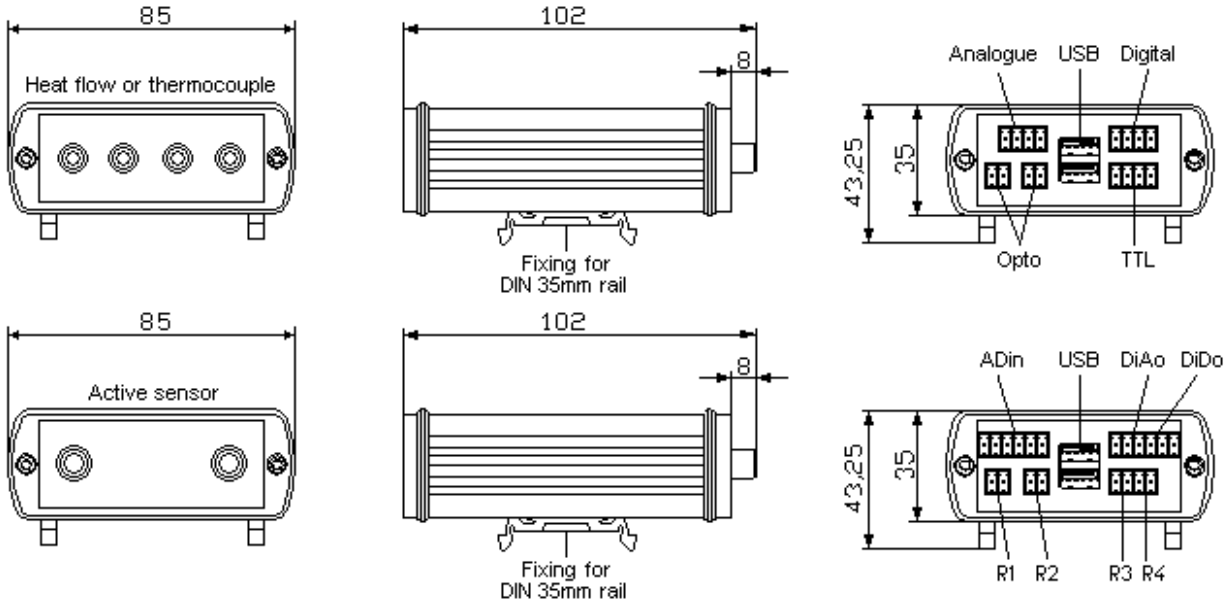
DEFAULT DISPLAY

A default display is shown when you let the interface free for about 20 seconds. To exit this default display and enter the menu, you must press both buttons. This display can be selected in the interface->display menu. It is selectable from 1 to 4 pages of 3 data, chosen in input values, regulator values, mathematic functions, date and time. On multi page display, swap time is about 5 seconds.

SEQUENCER (+S)

An internal sequencer is running in aDDa-R+S modules. Up to 4 simultaneous tasks can run with approximately 26 instructions performing operations on all measurements, mathematic functions, 16 temporary memories, 16 self-discounting timers, 16 counters, 4 parameters, 2 variables and regulator's consigns. Parameters can be set with the local interface or aDDa-V (≥3.21) calibration window. Variables can be displayed on local interface (replace date and time) or acquired with aDDa-V.
The program is conceived with the Sequencer software.

CROWDING



CONTENTS

- 1 aDDa module
- 1 USB cable type A-A of 0.3m
- 2 Phoenix 2 pins jacks for opto-coupled outputs
- 1 Phoenix 4 pins jack for opto-coupled outputs
- 2 Phoenix 4 pins (A) / 6 pins (B) jacks for automat inputs

TFX SA reserves the right to change the circuitry and specifications without notice at any time.