Analog Module AM-203

- **24 bits inputs for heat flux and thermocouple**
- **1 synchronization PNP input**
- **1 0-10V or PNP input**
- **2 integrated regulators**
- **2 window tests**
- **2-result sequencer**
- **2 PNP outputs**
- **2 0-10V outputs**
- 3 embedded thermal functions
- 17,5 mm compact case for 35mm DIN rail

PRODUCT FAMILY

AM : Analog module is a programmable signal conditioner with integrated advanced control system.

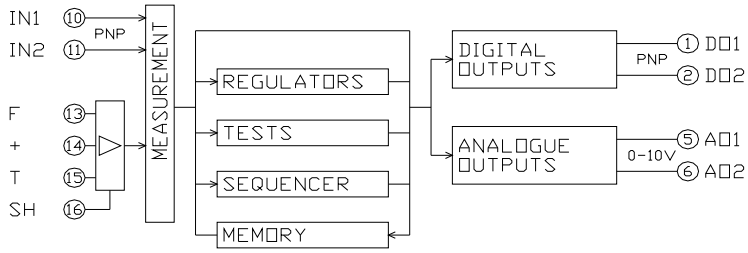
BC : Bus Coupler is a USB interface which handle communications of multiple modules making possible to provide software traceability (Tfx-Lab or other).

CC : USB Cable Coupler for easy configuration of analog modules dedicated to process control.

ARTICLE NR

Model	Product reference	Description
203.AM	**AM**	**Analog Module**
203.PS	AM.PS	Analog Module with programed sequence
203.PU	AM.PU	Pre-programed Analog Module (see dedicated form)
204.BC	BC	USB ou RS232 fixed bus coupler, for data acquisition purpose
204.CC	CC	USB cable coupler for configuration

BLOCK SCHEME

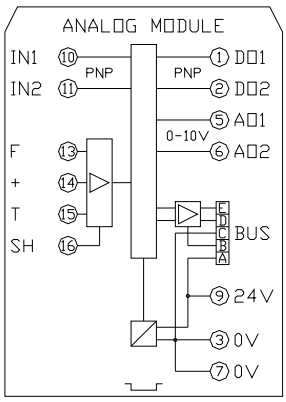


The analog module include three working groups :

- Measurement (PNP, 0-10V or mV)
- Control (regulators, tests, sequencer)
- Outputs (digital, analog)

All signals and variables are shared between these three groups.

CABLING



Product label

Minimal use :

- Plug 24V and 0V power supply
- Connect heat flux sensor or thermocouple on 13 to 16 inputs
- Plug outputs according to need
- If not already configured, set up the module parameters

If several modules are connected together, power supply is automatically shared. It is therefore not necessary to plug power supply on each module.

Ground is connected through DIN rail.

POWER SUPPLY AND COMMUNICATION

ELECTRICAL SPECIFICATIONS

Name	Description	Min	Typ	Max	Unit
VCC	Supply voltage	18	24	30	V_{DC}
I_{in}	Consumption		TBD		mA

- Protected against polarity errors.

COMMUNICATION

RS485, half Duplex, with proprietary protocol.

Name	Description	Min	Typ	Max	Unit
B_{rate}	Baud rate		38'400		bps
Address	Identification address number	0x10	**0x14**	0xEF	

CONNECTORS

Pin	Name	Description
9	24V	Positive supply
3 et 7	0V	Reference potential

For 0.2..2.5 mm^2 wires (AWG24..12)

CONNECTORS FOR INTEGRATED BUS

Pin	Name	Description
A	24V	Positive supply
B	DVCC	Communication supply
C	0V	Reference Potential
D	D-	Differential Communication RS485, negative polarity
E	D+	Differential Communication RS485, positive polarity
Shield	Ground	Through DIN35 rail

FLUX AND TEMPERATURE INPUTS

ELECTRICAL SPECIFICATIONS

Name	Description	Min	Typ	Max	Unit
R_{in}	Différential Input Resistance	200k			Ω
V_{step}	Resolution		24		bits
$noise_{pp}$	Peak to peak noise		1		µV
CMRR	Common Mode Rejection		100		dB
F_{Sample}	Sampling Frequency		8.3		Hz
$A_{in+/-}$	Analog Input	-0.03		5	V
A_{in+}-A_{in-}	Diffrential Voltage Input	-2.5		2.5	V
CMA_{in}	Common Mode Input		2.5		V

Temperature input can read type J, K or T thermocouples, ITS-90 standard

CONNECTIONS

Pin	Name	Description
13	F	Negative Heat Flux Input
14	+	Common Positive Input
15	T	Negative Thermocouple Input
16	SH	Shield (black)

For 0.14..1.5 mm^2 wire (AWG28..16)

PNP AND 0-10V INPUTS

Only IN2 can be set to read 0-10V

DIGITAL PNP INPUTS

Electrical Specifications

Name	Description	Min	Typ	Max	Unit
R_{in}	Input Impedance		50		k Ω
T_{detect}	Detection time		7.5		ms
F_{Sample}	Sampling Frequency		133		Hz
V_{in}	Analog Input Mode	0		30	V
V_{high}	High level detection voltage		12		V

ANALOG INPUT 0-10V

Electrical Specifications

Name	Description	Min	Typ	Max	Unit
R_{in}	Input Impedance		50		k Ω
step	Resolution		10		bits
$noise_{pp}$	Peak to peak noise level		20		mV
F_{Sample}	Sampling Frequency		133		Hz
V_{in}	Analog Input Mode	0		30	V
V_{err}	Saturation level		12.25		V

Gain and offset settings

Analog inputs require gain and offset settings in order to convert measured volts in proper desired units.
AM module work with the following formula :

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

Some examples :

Technical Specifications			Examples	Module	
Type	Gain	Offset		Gain	Offset
Temperature	0.4 °C/mV	-50°C à 0V	$Gain[°C/V]=Gain[mV/°C]*1000[mV/V]=400[°C/V]$ $Offset[V]=\frac{Offset[°C]}{Gain[°C/V]}=\frac{-50}{400}=-0.125[V]$	400	-0.125
Pressure	2000 bar	0V	$Gain[bar/V]=\frac{Range[bar]}{Plage[V]}=\frac{2000}{10}=200[bar/V]$	200	0

CONNECTORS

Connector	Name	Description
10	IN1	Synchronization Input
11	IN2	Auxiliary Input

For 0.2..2.5 mm^2 wires (AWG24..12)

PNP OUTPUTS

ELECTRICAL SPECIFICATIONS

Default conditions : V_{CC} = 24V, R_L=10kΩ

Name	Description	Min	Typ	Max	Unit
I_{Cmax}	Maximum Current		40		mA
Z	Impedance (PTC)		5		Ω
$V_{CE(sat)}$	Collector-Emitter Closed Voltage		0.7	1	V_{DC}

CONNECTORS

Connector	Name	Description
1	DO1	PNP 1 output
2	DO2	PNP 2 output

For 0.2..2.5 mm^2 wire (AWG24..12)

0-10V ANALOG OUTPUTS

ANALOG OUTPUTS
Electrical Specifications

Name	Description	Min	Typ	Max	Unit
R_{out}	Output Impedance		10		Ω
step	Resolution		16		bits
F_{Sample}	Output Sampling Frequency		TBD		Hz
V_{out}	Output Voltage	0		10	V
I_{max}	Maximum Current		6		mA
GND	Reference Voltage		0		V

CONNECTORS

Pin	Name	Description
5	AO1	0-10V Output 1
6	AO2	0-10V Output 2

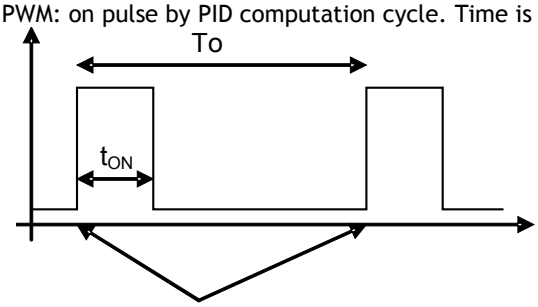
For 0.2..2.5 mm^2 wires (AWG24..12)

INTERNAL FUNCTIONS

AUXILIARY MEASUREMENTS
2 other measurements are performed by the module:
- Voltage supply
- Cold Junction Compensation Temperature (CJC)

MATHEMATICAL FUNCTIONS
One of the 3 following mathematical functions groups are computed:
- Low-Band Filter, Derivative and Phase Advance
- Radiative Target Temperature
- Conductive Target Temperature

REGULATORS
MA module embed 2 programmable regulators.
- Analog 0-10V are updated after each computation
- PNP outputs will follow PWM: on pulse by PID computation cycle. Time is in seconds.

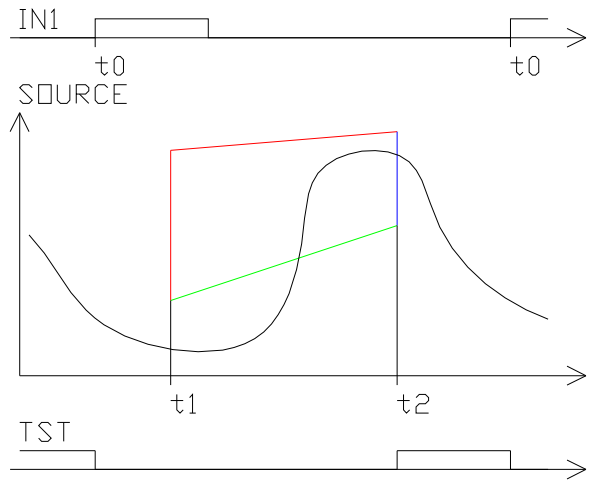


PID calculus (t_{ON}=Rn*To)

Regulators can be of the following 3 kinds:
- Constant output (may be controlled by the sequencer or an external software)
- Digital PID with a base time of To (for regulation)
- Hysteresis (for regulation local detection)

WINDOW TESTS

2 window tests are integrated in MA modules. Numerous options allow continuous detection, synchronized detection for one or two reference times.



Window test follow the procedure:

- wait for IN1 synchronization, set t0 reference time.
- reset preceding data
- at t1, input level control
- from t1 to t2, upper and lower limits control
- at t2, output level control and set the result to TEST variable.

If t1<0, limits are controlled from t0 to t2,TEST variable is set at t2.

If t2<0, control is continuous with t2 limits

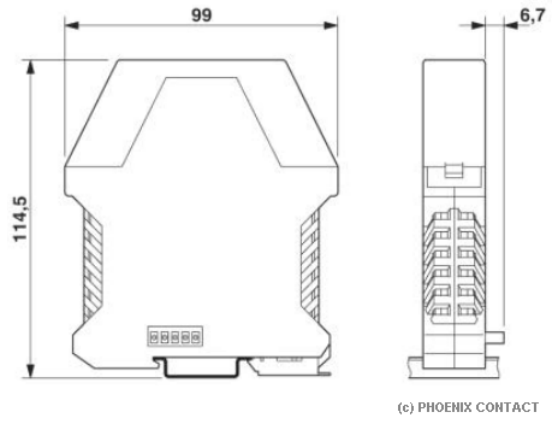
Window input or output can be authorized or not. Window upper and lower boundaries can be forbidden or authorized in input, output or both. Only one input and one output are validated.
Configuration and calibration software provide a graphical representation of actual settings.

SEQUENCER

An internal sequencer operates in the modules . Up to 4 simultaneous tasks can run with 26 instructions performing operations on all measurements, math functions, controllers, 16 temporary memories, 16 timers automatically decrementing to 0, 16 timers and 4 parameters.
The settings can be changed in the calibration window of the Adda-V.
The results are stored in 2 variables. They can be used by other functions.

Programming of sequences specific to applications is performed by authorized TFX's engineers.

SIZE



CONTENT

- 1 AM module
- 3 3-pin Phoenix Contact MSTBT 2,5/3
- 1 4-pin Phoenix Contact MC 1,5/4-ST-3,5 for heat flux sensor

TFX SA reserves the right to modify design and details at any time without warning.

FORM FOR FACTORY PROGRAMMING

MEASUREMENTS

Flux, temperature

Data		Value
Flux sensitivity [V.W^{-1}.m^2]		
TC kind		
Math function		
Order	Form factor	
Fc [Hz]	-	

IN2

Data	Value
Type	
Gain [user unitsl/V]	
Offset [V]	

REGULATORS

Data	Value
To (s)	

REG1

Data		Value
Mode		
Setting signal		
Setting level		
Source		
Gain	Hysteresis	
Ti [s]	ON	
Td [s]	OFF	
Max	-	

REG2

Data		Value
Mode		
Setting signal		
Setting level		
Source		
Gain	Hysteresis	
Ti [s]	ON	
Td [s]	OFF	
Max	-	

TESTS

AO1

Data	Value
Source	
Synchronization slope	
t1	
Max at t1	
Min at t1	
t2	
Max at t2	
Min at t2	
Input limit (t1>=0)	
Upper limit (t2>0)	
Lower limit (t2>0)	
Output limit (t2>=0)	

AO2

Data	Value
Source	
Synchronization slope	
t1	
Max at t1	
Min at t1	
t2	
Max at t2	
Min at t2	
Input limit (t1>=0)	
Upper limit (t2>0)	
Lower limit (t2>0)	
Output limit (t2>=0)	

SEQUENCER

Data	Value	Data	Value
Parameter 1		Parameter 3	
Parameter 2		Parameter 4	
Program			

DIGITAL OUTPUTS

DO1

Data	Value
Function	
BIT1	
BIT2	

DO2

Data	Value
Function	
BIT1	
BIT2	

ANALOG OUTPUTS

AO1

Data	Value
Source	
Value at 0V (min)	
Value at 10V (max)	

AO2

Data	Value
Source	
Value at 0V (min)	
Value at 10V (max)	

Communication	Address	

Send

