1. Product Description

The Piccolo Programmable Logic Controllers Series were designed for applications in medium and small size automation and processes control.

The compact design integrates in one unique plastic case a full featured CPU, digital I/O, analog I/O and high speed counter and a serial port for programming or connection to ALNET I network.

The I/O points quantity and output type varies according to the PC model, matching exactly the application needs.

The following PCs are available:

- PL104/R: PC whit 16 24Vdc inputs, 16 relay outputs, 3 serial channel, real-time clock - expandable
- PL104/T: PC whit 16 24Vdc inputs, 16 24Vdc outputs, 3 serial channel, real-time clock - expandable
- PL105/R: PC whit 12 24Vdc inputs, 6 relay outputs, 3 serial channel, real-time clock - expandable
- PL105/T: PC whit 12 24Vdc inputs, 6 24Vdc outputs, 3 serial channel, real-time clock - expandable

2. Packing List

The product package contains:

- PL104/R or PL104/T or PL105/R or PL105/T: programmable controllers with integrated I/O

3. Functional Characteristics

3.1. General Characteristics

	PL104		PL105	
	/R	/T	/R	/T
Total I/O points	132	132	114	114
Modular I/O interface:				
- modules (max. in bus)	3	3	3	3
- digital I/O (max. points)	96	96	96	96
Integrated I/O interface:				
- 24 Vdc inputs	16	16	12	12
- relay outputs	16	-	6	-
- transistor outputs	-	16	-	6
- analog inputs (10)	2	2	-	-
- analog outputs (10)	2	2	-	-
- interruption input	1	1	-	-
- high speed counter input (1)	1	1	-	-
Communication interface:				
- type	Serial RS-232C e RS-485 (8)			
- protocol (2)	ALNET I (9)			
- baud-rate (3)	Configurable (3)			
RAM Memory for program application	64 Kbytes			
Flash EPROM Memory for program application	32 Kbytes			
Program and data retention	Yes			
CPU status LEDs	Yes			
Real time clock	Yes			
Clock frequency	15 MHz			
Hardware watchdog timer	Yes			
Protection (4)	IP20			
Temperature:				
- operation (5)	0 a 60°C			
- storage (6)	-25 a 70°C			
Operation humidity (7)	5 a 95%			
Weight:				
- net	500 g	500 g	450 g	450 g
- shipped	550 g	550 g	500 g	500 g

(1) Configured as interruption or second counter input
(2) ALNET I version 2.00
(3) Configured in programmer MasterTool 300 to 9600 bps
(4) Degree of protection: against contact with live moving parts inside and no protection against water, according to IEC Pub. 144(1963) standard
(5) Exceeds IEC 1131
(6) According to IEC 1131
(7) According to IEC 1131 level RH2
(8) The PCs PL104 e PL105 have one RS-232/RS485 serial channel, one RS-232C with modem signals and one RS-485 (2 wires)
(9) Protocol configurable by F module
(10) Only 2 inputs points, or 2 output points, or 1 input point and 1 output point can be used simultaneously

3.2. Electrical Characteristics

- Power supply voltage: 19.2 to 30 Vdc filtered (including ripple)
- Consumption:

PL 104/R	620 mA
PL 104/T	700 mA
PL 105/R	490 mA
PL 105/T	520 mA

Calculated with all points energized
24Vdc Output source current not included
Input sink current not included

- Maximum power dissipation under nominal voltage:

PL 104/R	11 W
PL 104/T	13 W
PL 105/R	6 W
PL 105/T	8 W

- Internal lithium battery CR2032 - 3V
- Electrostatic surge discharge:
  according to IEC 1131 standard, level 4
- Electrical noise immunity (oscillating wave):
  according to IEC 1131 and IEEE C37.90.1 (SWC) standards
- Electrical noise immunity (fast transient):
  according to IEC 801-4 standard, level 3 and IEC 1131 standard, level B
- Radiated electrical field immunity:
  10 V/m @ 140 MHz
  according to IEC 1131 standard
- Electric discharge protection
  according to IEC 536 (1976) standard, class I.

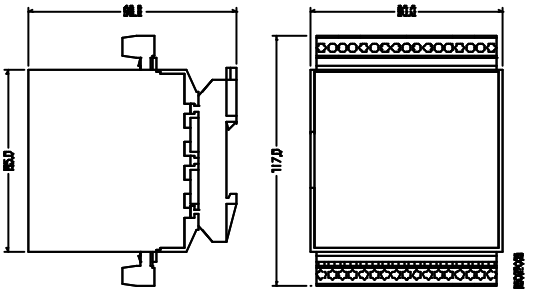
3.3. Software

- Programming Language: ladder diagram, structured in modules with functions and subroutines
- Programmer:
  - For PL 104/R and PL 104/T:
    MT 4000 - version 1.06 or later
    MT 4000/PL - version 1.06 or later
    MT 4100 - version 2.01 or later
    MT 4100/PL - version 2.01 or later
  - For PL105/R and PL105/T:
    MT 4000 - version 1.08 or later
    MT 4000/PL - version 1.86 or later
    MT 4100 - version 2.01 or later
    MT 4100/PL - version 2.01 or later
- PL104/R, PL104/T, PL105/R and PL105/T software functions included in the programmer:
  F-CONT.005 - access to integrated counter points (only to PL104)
  F-ANLOG.006 - access to integrated analog points (just to PL104)
  F-PID.033 - PID control function
  F-RELG 0.48 - Real time clock
- Total application program memory:
  - 64 Kbytes RAM
  - 32 Kbytes Flash EPROM
- On-line programming without stopping execution, through serial channel.
- Digital processing operands (1 bit):
  - Inputs (E):
    total input points capacity: 64 (E000.0 to E007.7) - PL104/PL105 model
  - Outputs (S):
    total output points capacity: 64 (S008.0 to S015.7) - PL104/PL105 model
  - Auxiliary (A):
    up to 768 auxiliary relays (A000.0 to A095.7)
- Numerical processing operands:
  - Constants:
    memory constant (KM): 16 bits, complement of 2 format
    decimal constant (KD): 32 bits, BCD with signal
  - Simple operands:
    memory (M): up to 4096 operands (M0000 to M4095), 16 bits, complement of 2 format
    decimal (D): up to 2048 operands (D0000 to D2047), 32 bits, BCD format with signal
  - Table operands:
    memory table (TM): up to 255 operands (TM000 to TM254) with up to 255 positions. Each position is equivalent to one M operand.
    decimal table (TD): up to 255 operands (TD000 to TD254), up to 255 positions. Each position is equivalent to one D operand.

> Operands S, A, M and D can be changed to retentive by theprogrammer. The retentive operands preserve their values even on power failures. The non-retentive ones will be zero on power up. The table operands are all retentive.
>
> All numeric operands (KM, KD, M, D, TM and TD) allow signal treatment. The operand quantity (M, D, TM and TD) is configurable for each application, memory capacity (8Kbytes) limits the operand quantity available.

- Operand memory capacity: 15,5 Kbytes
- Average execution time for contact instruction: 5 µs
- Average memory occupation for contact instruction: 8 bytes

4. Physical Dimensions



dimensions in mm

5. Integrated I/O Interface

5.1. Digital Inputs

5.1.1. General Characteristics

- Input points quantity:

16 in PL104
12 in PL105

- Input points are not isolated between each other (0V is the same for all points)
- Individual optocoupling for each point
- Status information for each point (LED)
- Process connection: terminal block, 0.5 up to 1.5 mm^2 wire

5.1.2. Eletrical Characteristics

- Input voltages:
  - 0 logic level: 0 Vdc to 5 Vdc
  - 1 logic level: 13 Vdc to 30 Vdc
- Impedance: 5KΩ
- Transition time 0-1 and 1-0: 2 ms
- Isolation: 1,000 Vdc between inputs 0V and ground or system

5.2. PL104/R, and PL105/R Digital Outputs

5.2.1. General Characteristics

- Output type: Normally open contact relay
- Number of points:
  16 in PL104/R
  6 in PL105/R
- Individual optocoupling for each output point
- Status information for each point (LED)
- Process connection: terminal block, 0.5 up to 1.5 mm^2 wire

5.2.2. Eletrical Characteristics

- Nominal maximum commutation voltage: 30 Vdc or 250 Vac
- Nominal current per point: 2 A for resistive loads and 0.5A for inductive and lamp loads
- Maximum total current on outputs points: 8A
- Protection against malfunction:
  disable outputs when in CPU is in error
  hardware watchdog timer
- Protection against power fault:
  disable outputs in power fail or power fault
- External supply current:
  140 mA for PL104
  50 mA for PL105
- Isolation: 1000 Vdc between output's 0V and ground or system

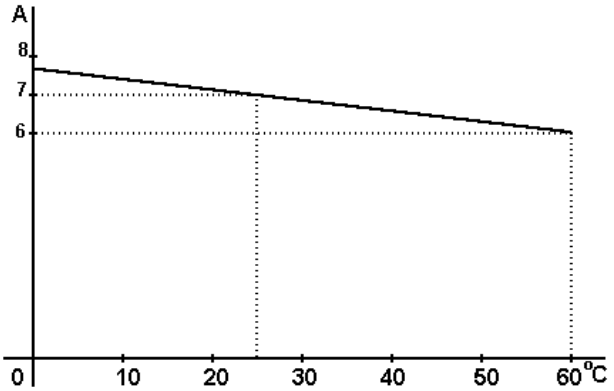
5.3. PL104/T, and PL105/T Digital Outputs

5.3.1. General Characteristics

- Output type: source transistor
- Number of points:
  16 in PL104/T
  6 in PL105/T
- Output points not isolated between each other (0V is the same for all I/O points).
- Individual optocoupling for each output point
- Status information for each point (LED)
- Process connection: terminal block, 0.5 up to 1.5 mm^2 wire

5.3.2. Electrical Characteristics

- Power supply voltage: 19.2 a 30 Vdc
- Maximum current per point: 0.5 A
- Maximum total current X temperature:



- Protection against malfunction:
  disable outputs when in CPU is in error
- Protection against power fail:
  disable outputs in power fail or power fault
- Protection against overcurrent:
  deactivates outputs if any point's current exceeds 0.5A per point. Outputs must be powered on again to establish normal operation.
- Isolation:
  1,000 Vdc between inputs 0V and ground or system

5.4. High Speed Counter

- Quantity: 2

PL105/R and PL105/T don't have high speed counter.

5.4.1. Configured as High Speed Counter

- Maximum operation voltage: 30 Vdc
- High to low level transition counting. Not compatible with quadrature signals.
- Input impedance @ 5V:
  > 1 MΩ
  above 10 V, the impedance is 15 kΩ
- Logic 1 level:
  Minimum voltage: 3 V
- Logic 0 level:
  Maximum voltage: 2 V
- Histeresis: 1 V
- Maximum frequency: 10 kHz (square wave, 50% duty cycle)
- Minimum pulse width (logic 0 level): 25 µs
- Process connection: terminal block, 0.5 up to 1.5 mm^2 wire
- Programming: F-CONT.005 function module.

5.4.2. Configured as Interrupt Input

- Maximum operation voltage: 30 Vdc
- Low to high level transition.
- Input impedance @ 5V:
  > 1 MΩ
  above 10V, the impedance is 15 kΩ
- Logic 1 level:
  Minimum voltage: 3V
- Logical 0 level:
  Maximum voltage: 2V
- Histeresis: 1V
- Maximum frequency:
  Limited by the software response time.
- Minimum pulse width (0 level):
  25 µs
- Process connection: terminal block, 0.5 up to 1.5 mm^2 wire
- Programming: E-020 module

5.5. Analog Channels

- Quantity: 2, not isolated. Each one can be configured to be input or output.

PL105/R and PL105/T don't have analog channels.

- Resolution: 1/256 (8 bits)
- Monotonicity: yes
- Maximum error @ 25°C: 0.2% of maximum value
- Process connection: terminal block, 0.5 up to 1.5 mm^2 wire
  Use shielded cables grounded in one extremity
- Programming: F-ANLOG.006 software function module

5.5.1. Configured as Input

- Signal level: 0 to 10 Vdc
- Input impedance: > 10 MΩ
- Resolution: 8 bits
- LSB value: 39.2 mV
- Maximum error @ 25º: ±1 LSB
- Delay time: 305 ms
- Conversion type: successive approximations
- Overvoltage allowed: 15 V
- Monotonicity: yes

5.5.2. Configured as Output

- Output level: 0 a 10 Vdc
- Resolution: 8 bits
- LSB value: 39.2 mV
- Maximum error @ 25º: ±1 LSB
- Loads allowed: resistive, capacitive or inductive
- Maximum capacitive load: 10 nF
- Maximum resistive load: 1KΩ
- GND and power supply short-circuit protection
  Maximum current to GND and power supply: 20mA
- Monotonicity: yes

6. Programming

Piccolo Series uses ladder diagram language. Its main advantage is being graphical and very similar to conventional relay diagrams. Programming is done with the following instruction set. For more information, see the MASTERTOOL Programmer User's Manual.

The instruction set is divided in 9 groups:

- RELAYS
  - RNA - Normally opened contact
  - RNF - Normally closed contact
  - BOB - Simple coil
  - BBL - Turn-on coil
  - BBD - Turn-off coil
  - SLT - Jump coil
  - PLS - Pulse relay
  - RM - Master relay
  - FRM - End of master relay
- MOVE
  - MOV - simple operands move
  - MOP - partial operand move
  - MOB - operand block move
  - MOT - operand table move
  - MES - I/O move
  - CES - I/O conversion
  - AES - I/O refresh
  - CAB - Constant block loading
- ARITHMETIC
  - SOM - Addition
  - SUB - subtraction
  - MUL - multiplication
  - DIV - division
  - AND - logic AND between operands
  - OR - logic OR between operands
  - XOR - logic XOR between operands
- COUNTERS
  - CON - simple counter
  - COB - bi-directional counter
  - TEE - power on timer
  - TED - power off timer
- CONVERSION
  - B/D - binary to decimal conversion
  - D/B - decimal to binary conversion
- TEST
  - CAR - load operand
  - = - equal
  - < - lesser
  - > - greater
- INDEXED
  - LDI - turn on or off indexed points
  - TEI - indexed points test
  - SEQ - sequencer
- CALL
  - CHP - call procedure module
  - CHF - call function module
- LINKS
  - LGH - horizontal link
  - LGV - vertical link
  - LGN - logical NOT link

7. ALNET I

All Piccolo Series PCs conforms to version 2.00 ALNET I network commands. This feature makes possible to link them in networks or to AL-600 series, AL-2000 series, AL-3000 series and QUARK series PCs, or peer to peer with Foton MMI.

8. Manuals

For more technical details, installation, programming and Piccolo series PCs user safety, please read the following manuals:

- Piccolo Series User's Manual
- MT 4000 User's Manual - Master Tool
- MT 4000/PL User's Manual - Master Tool/PL
- MT 4100 User's Manual

9. Ordering Data

9.1. Products

	Description
PL104/R	PC with 16 24 Vdc inputs, 16 relay outputs, 3 serial channel, real-time clock - expandable
PL104/T	PC with 16 24 Vdc inputs, 16 24Vdc outputs, 3 serial channel, real-time clock - expandable
PL105/R	PC with 12 24 Vdc inputs, 6 relay outputs, 3 serial channel, real-time clock - expandable
PL105/T	PC with 12 24 Vdc inputs, 6 24Vdc outputs, 3 serial channel, real-time clock - expandable

9.2. Related Items

Cable	Interconnected equipment		Length
AL-1330	Piccolo (DB9)	IBM - PC (DB9) programmer	3 m
AL-1333	Piccolo (DB9)	FT1 and FT3 (RS232)	3 m
AL-1335	Piccolo (DB9)	AL-1413	3 m
AL-1337	Piccolo (DB9)	FT5 and FT10 (RS232)	3 m
AL-1338	Piccolo (DB9)	FT1, FT3, FT5 and FT10 (RS485)	3 m
AL-1714	Piccolo (RJ45)	Piccolo (RJ45)	3 m
AL-1715	Piccolo (RJ45)	IBM - PC (DB9) programmer	3 m
AL-1716	Piccolo (RJ45)	FT1, FT3, FT5 and FT10 (RS485)	3 m
AL-1717	Piccolo (RJ45)	AL-2600	3 m
AL-1718	Piccolo (RJ45)	AL-1413	3 m
AL-1719	Piccolo (RJ45)	FT5 and FT10 (RS232)	3 m
AL-1720	Piccolo (RJ45)	FT1 and FT3 (RS232)	3 m
AL-1721	Piccolo (RJ45)	MODEM	3 m
AL-1722	Piccolo (RJ45)	FT51, FT52 andFT55 (RS232)	3 m
AL-1723	Piccolo (RJ45)	FT51, FT52 andFT55 (RS485)	3 m
AL-2305	Piccolo	AL-2600	3 m

Others	Description	Function
PL143/R	Module with 16 24 Vdc inputs and 16 relay outputs	Digital I/O module
PL143/T	Module with 16 24 Vdc inputs and 16 24Vdc transistor outputs	Digital I/O module
PL110	Module with 16 24 Vdc inputs	Digital I/O module
PL140	Module with 4 analog inputs 4 to 20mA, -10 to 10V, configurable thermocouple, 2 analog outputs 4 to 20 mA and -10V to 10V, 12 bits	AnalogI/O module
PL141	Module with 16 analog imputs and 4 analog outputs 4 to 20 mA and -10V to 10V, 12 bits	Analog I/O module
AL-1517 or PL150	110/220 Vac, 24Vdc, 1A , rail mounting TS32/35	Power supply
AL-1518	**Power Supply 24Vdc, 5A**	Power supply
QK1500	TS32/35 CPU and I/O modules rail mounting	Mounting rail

10. Revisions

This Technical Characteristic is valid for PL104/R, PL104/T, PL105/R and PL105/T revision A and above.

The revision of this document is shown on top of the page, indicating contains changing or format improvements.

ALTUS has rights to modify this TC without previous notice, in order to improve product characteristics.

The following report shows each revision and corresponding remarks:

Revision: A	Date: 11/01/2000
Approval: Luiz Gerbase	
Author: Alexandre Hessler	

Remarks:

- Initial revision