1. Product Description

The CPU AL-2002/MSP-C belongs to the AL-2000 PLC Series. It can control up to 512 I/O.

The programming software is based on structured ladder diagram. It is compatible with AL-600, AL-2000, AL-3000 and QUARK PLC Series.

It has two network interfaces embedded. The ALNET-II is a high performance 1Mbps network for distribution application. The ALNET-I is a 9600bps network for PLC programming and systems supervision.

It has a synchronization network that guarantee maximum of 1 ms between different PLCs.

2. Specifications

2.1. General

- Maximum digital I/O: 512
- Maximum I/O cards: 142
- Maximum analog I/O: limited by available I/O cards position
- RS-232C interface for ALNET I V1.00 and V2.00 protocols
- EIA 485 interface for ALNET II protocol
- on fly cards exchange
- Real time clock embedded
- CPU status LEDs on the frontal panel
- Program and operand memory retentive by lithium battery with automatic and periodic self-test
- FLASH EPROM memory to application program
- Intel® 80C152 main micro controller
- Intel® 80C32 coprocessor
- Multiprocessor capacity:
  - AL-2005 (Real-Time Multitask Processor)
  - AL-2006 "Brother" (Redundancy processor and/or remote I/O)
  - AL-3130 (event sequence)
  - AL-3405 (Interface Ethernet)
- Clock frequency: 15MHz
- Watch-dog-timer
- Operating temperature: 0 a 60°C
      exceed IEC 1131
- Storage temperature: -25 a 75°C
      according to IEC 1131
- Operating air relative humidity: 5 a 95% without condensation
      according to IEC 1131, level RH2
- Weight:
      net: 420g
      packed: 570g
- MTBF: 40.000h @ 40°C
      according to MIL-HDBK-217E
- Protection: IP30, against accidental tools access and without water protection
      according to IEC Pub. 144 (1963), installed product

2.2 Electrical

- Operating voltage:
      +5 VDC ±5%
      +15 VDC ±5%
      -15 VDC ±5%
      +5 VDC ±10%
- Power requirements:
      300 mA @ +5 VDC
      250 mA @ +15 VDC
       30 mA @ -15 VDC
       70 mA @ +5 VDC
       30 µA @ battery when system is off

> Battery life depends on number of cards with retentive memory feature.

- Card dissipation: 11 W
- Electric static discharge protection (ESD):
      according to IEC, level 3
- Electrical noise immunity (oscillating wave):
      according to IEC1131, severity level A, and IEEE C37.90.1 (SWC)
- Irradiated electrical field immunity:
  3 V/m @ 140 MHz
      according to IEC Draft Task Group 65a (1988)
- Protection against electrical shock:
      according to IEC 536 (1976), class I

2.3. Software

- Programming language: ladder diagram structured in modules with functions and sub-routines
- Programming tools: AL-3830 v2.0 or higher, or MASTERTOOL (programming tool for WINDOWS®) for IBM-PC® compatibles
- Total application program capacity: 256 kbytes:
  RAM: 32 or 128 Kbytes
  FLASH EPROM: 64 or 128 Kbytes

> 32k RAM and 64k FLASH EPROM are product standard. It is possible expand memory capacity according to previous description.

- On line software programming
- Functions and sub-routines featuring
- Operands for digital processing:
  - Input (I): up to 512
  - Output (O): up to 512
  - flag (A): up to 768 flags

> The possible total number of I/O are 512. That means the sum of inputs and outputs must be smaller or equal to this limit.

- Operands for numerical processing:
  - memory constant (KM): 16 bits, complement of 2 format
  - decimal constant (KD): 32 bits, signaled BCD
  - memory (M): up to 7936, 16 bits binary format
  - decimal (D): up to 3968, 32 bits, signaled BCD format
  - memory table (TM): up to 255 with up to 255 positions. Each position is one M operand.
  - decimal table (TD): up to 255, up to 255 positions. Each position is one D operand.

> All numeric operands (KM, KD, M, D, TM and TD) allow signal treatment. O operand number is configurable for each application, its limit is the memory capacity available (15,5 Kbytes).

> The operands S, A, M and D can have retentive feature. The retentive operands preserve their values even on power failures. The non retentive ones will be zero on power failure. The table operands are all retentive.

- Memory capacity for operands:: 15,5 Kbytes
- Medium execution time for contact instruction: 5 µs
- Medium memory occupation for contact instruction: 8 bytes

3. Physical Dimensions
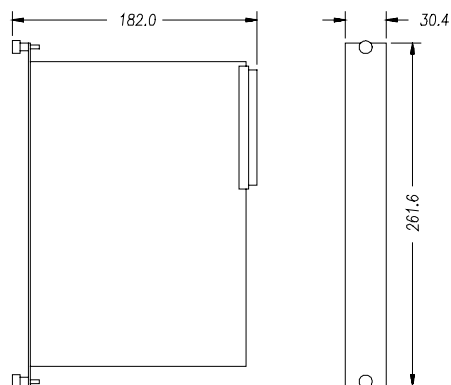
4. ALNET II network

The CPU AL-2002/MSP has a industrial high speed network embedded, the ALNET-II. It allows up to 32 nodes on the same sub-network. This network allows safely and fast distribution control.

The basic features are:

- Bus topology
- Up to 2 km on RS-485, and 4 km on optic fiber (further distances can be reached with repeaters)
- Communication speed from 25 Kbit/s up to 1 Mbit/s
- Access mode: deterministic, multi master
- Physical access: EIA 485 with galvanic isolation
- Boadcast and multicast capacity
- Full automatic error control and retransmission
- Up to 32 nodes by sub network
- Up to 64 sub networks
- Operates on optic fiber with optic modems. So it allows reach long distances, higher speed and noise immunity
- Program download and upload by network. Allows full programming of AL-2000 CPU family from PC compatible based software.

5. Real Time Clock and Synchronism

The AL-2002/MSP has Real Time Clock embedded in the coprocessor 80C32.

The synchronism network embedded allows keep several CPUs synchronized with up to 1ms precision. This network is dedicated for this function.