MicroSTER

Digital Datalogger AR-4c

The AR-4c datalogger is the newest solution in the AR-type dataloggers' family. It maintains all their functional features, but has been enriched with respect of construction, design and functionality. The most important advantages of the AR-4c are:

1. Full compatibility with previous versions,
2. Modular, compact mechanical construction and attractive design,
3. Inbuilt, color graphical display with a touchscreen (5.7'', 640 x 580 pixels),
4. Inbuilt voice recorder with four-channels' mixer,
5. Universal communication interface,
6. Flexible utility software,
7. Logs up to 4080 binary and 255 analogue signals

Purpose

The AR-4c Digital Datalogger serves for registering of different binary, analogue and acoustic values characterizing the operation of various machines, devices and whole industrial objects. The ability of registering of huge amount of incoming signals makes it possible to apply the datalogger even in relatively big industrial systems. The AR-4c can recorder sound information taken by its audio channels synchronously with other input data. The datalogger can be used as typical "black box" gathering important information about the work of controlled object in order to potential inspection and analysis in case of eventual accidents or breakdowns, but also, thanks to equipping it with graphical peripheral devices cooperating with advanced communication & visualization software in can make a valuable element of modern industrial SCADA (Supervisory Control and Data Acquisition) system. The datalogger can also pose an important element of a bigger industrial control system working as networks' integrator and data server.

Functions

The AR-4c Digital datalogger performs following functions:

- Continuous scanning of input signals with defined frequency,
- Input data analysis, compression and logging,
- Evaluation of positions of controlled elements based on encoders output,
- Audio data recording,
- Continuous system state monitoring on local display,
- Data forwarding from internal data storage to remote computers,
- Data server functions,
- Making additional data archives on mobile mass storage devices
- Web-server functionality,
- Generating output signals (relays and analogue signals) as results of different mathematical and logical functions performed on input data – for example alarms from thresholds' exceeds.

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Modular structure

The datalogger can be freely configured using different types of input / output modules:

- 16, 32 digital input boards in 24V or 100V DC standard (or other upon demand)
- 2, 8, 16 analogue input boards (current or voltage inputs in automatics standard or other)
- Communication cards for PLC systems servicing different fieldbus protocols:
  - Profibus DP (Master i Slave)
  - Modbus Plus, Modbus RTU
  - Ethernet/IP and Modbus over Ethernet
  - Other on demand
- 8, 16, 30 relay outputs' cards,
- Additional 8 acoustic inputs' cards

It is possible to connect to the AR-4c remote digital and analogue input / output modules which can communicate with the datalogger via Modbus RTU protocol by means of a traditional cable connection or wireless link.

fig.1. AR-4c modular design schema

Reliability and safety of operation

The AR-4c datalogger is designed in a way to concurrent executing multiple self-tests, in order to detect internal hardware and software faults, simultaneously with normal operation. It possesses two independent "Watch-Dog" circuits, thus every hardware or software defect can be found out after one second time. In case of a breakdown, depending on error's type and danger, the datalogger generates two output signals which are sent to two relays' outputs (free relays' contacts):

1. READY or Not READY,

which informs about serious faults or failures

2. FAULT SIGNALLING

- generated when other, non critical error is detected.

Additionally all errors, faults and other problems are continuously monitored and logged in a special trace memory simplifying device's diagnostics and maintenance.

Signals' sources

- Relay and contact circuits,
- Measuring sensors, converters and transducers,
  - Shunts and other sources of current or voltage signals,
  - Hall effect sensors,
  - Manometers and other sensors of pressure and force,
  - Flow and level meters,
  - Incremental and absolute encoders,
  - Temperature and humidity sensors
- Sound sources:
  - Acoustic signals of specific frequencies,
  - Conversations and other sounds of frequency up to 4 kHz
- Digital values deriving from PLC's and other digital measuring devices.

Datalogger's software ensures full synchronization of data scanning from all above mentioned sources.

Principles of operation

The AR-4c datalogger scans input signals with defined frequency which can be programmed for up to 1000Hz. The data can be received in a classical way – from binary or analogue inputs, but also they can be transmitted from PLCs via different industrial buses. Thanks to equipping the datalogger with two quadrature inputs where the pulse signals from encoders can be sent the AR-4c can register two positions and velocities.

Both the construction and the software make it possible to reading and resending data by remote input / output modules.

All collected information is logged in an internal non-volatile storage, which capacity is sufficient for storing data for longer than several months of continuous object's work. The registration progresses in a continuous manner, after the storage is overflowed the old data are over-written by the current ones and the data reading or archivization on external devices (mass storage, computer) can be carried on in a multi-access way and does not disturb the registration process itself.

Thanks to its module construction and flexible software the AR-4c Digital Datalogger is simply reconfigurable and can be easy adjusted both to the installation demands and the customer's requests.

For the AR-4c can be simultaneously equipped with communication cards supporting different fieldbus protocols it is possible to use it as a network link enabling fast data interchange among PLCs provided by different producers.

The data stored in the AR-4c can be printed on local printer, displayed on local or remote displays and it can be sent to visualization panels where can be graphically presented in "on-line" or "back-browsed" mode.

The AR-4c can be connected via network interface with many computers where the data transmitted from the datalogger can be displayed, archived or processed for statistical or reporting purposes.

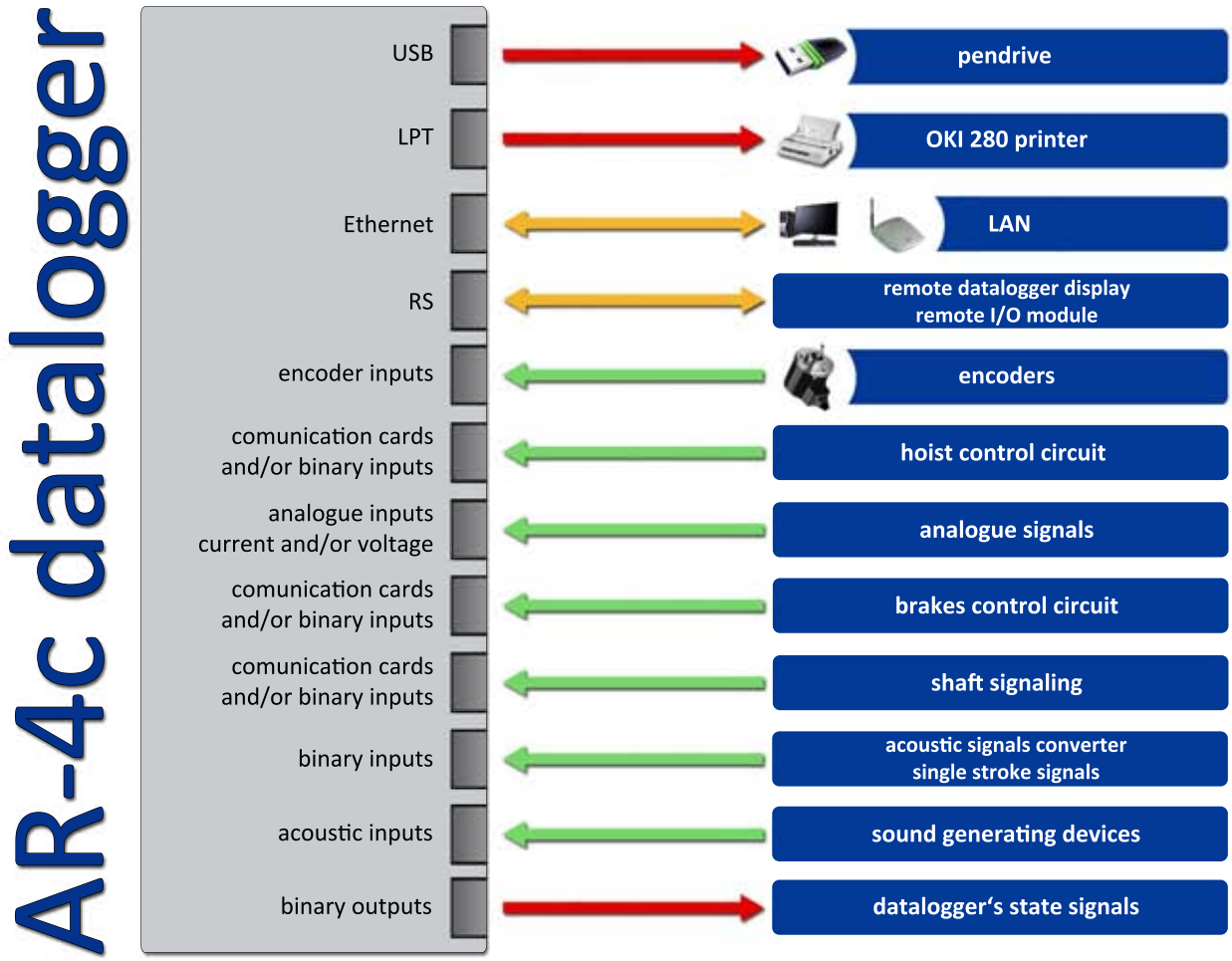

fig.2. Means of interrelating the AR-3c register with hoist's systems

Local graphical display

The AR-4c is equipped with a local graphical display with a touch-screen of a good resolution 640 x 480 points. Such resolution makes it possible to apply advanced graphical user interface.
Additional, dedicated software supports both on-the-fly and archive data presentation. It enables user to monitor current object state represented by rich set of controls. The software is also equipped with tools for basic maintenance:

- adjust date/time/timezone
- back up data to external USB stick
- on-the-fly fault monitoring
- display internal event log

fig. 3. local AR-4c datalogger display

Visualization system

Ar-4c dataloggers, due to their multi-protocol support, can communicate with many modern visualization systems. It works with the dedicated software (such as ARAMON, which uses its own communication protocol) and also with universal SCADA systems (using standard industrial protocols).
Main advantage of dedicated software (Logger, ARAMON) is its support for browsing through archived data gathered by the datalogger, where SCADA software can only display current data. Additionally Logger program enables user to store data one his PC, which allows storing almost unlimited number of archives.
Professional SCADA software (such as Intouch offered by Microster) is design to let the user configure advanced visualization on his own. This solution is perfect for those willing to build intuitive, graphically attractive and multi-panel visualization systems based on industrial touch screens.
Visualization software may be installed on any hardware platform. It works on AR-4c local display, various embedded devices, touch screen consoles, palmtops, notebooks and standard PCs.

Voice recorder

The Ar-4c audio is equipped with 4 external audio inputs. This can be extended using additional audio/analogue card. Recorded audio data are split into one minute long samples and stored in the *.gsm format. This compression algorithm (used by mobile phones) is sufficient for speech playback. The user may setup additional signal to instruct the datalogger, which audio data have high priority and should remain stored as long as possible.

LOGGER software (versions 2.0 – 4.x)

LOGGER is end-user program simplifying communication with datalogger. It can be installed on any standard PC running Microsoft Windows 98/Me/2000/XP/Vista/7. It may be also installed on Linux/Unix based systems, but requires emulator (i.e. wine). The LOGGER software uses standard TCP/IP protocol to communicate with the datalogger, which enables for both cable and wire less communication using standard, off-the-shelf devices. It addition LOGGER supports serial port communication for backwards compatibility with older dataloggers (AR-2c i AR-2c+).

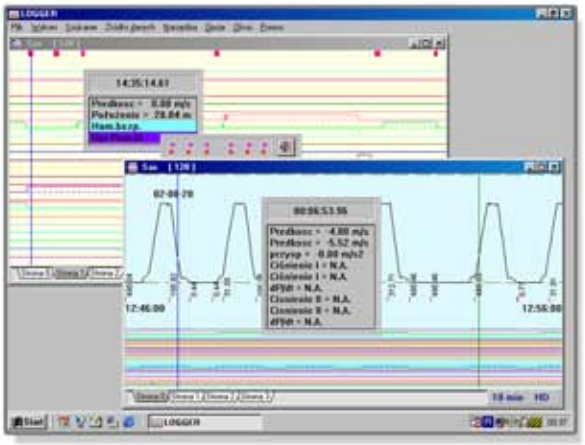

fig. 4. A sample screenshot of LOGGER program

The LOGGER program is handy tool supporting:

- datalogger's data visualization in both on-line and data archive mode.
- performing datalogger's storage archive on PC's hard drive.
- datalogger's audio data playback and archive
- various printouts (including visualization views and additional reports)

Structure and core software operation

The AR-4c datalogger is based on real time operating system running main control program as real time thread. The main thread's code is stored on build-in memory, programmed by manufacturer and unavailable for end-user.

Program's entire functionality - including the main one: gathering and storing data, and the rest responsible for communication, data visualization, printouts, etc. - is handled in separated, parallel threads. Time-critical operations are executed in real-time thread assuring its execution in exact moment of time. The schema shows program structure and the basics of communication between program's components.

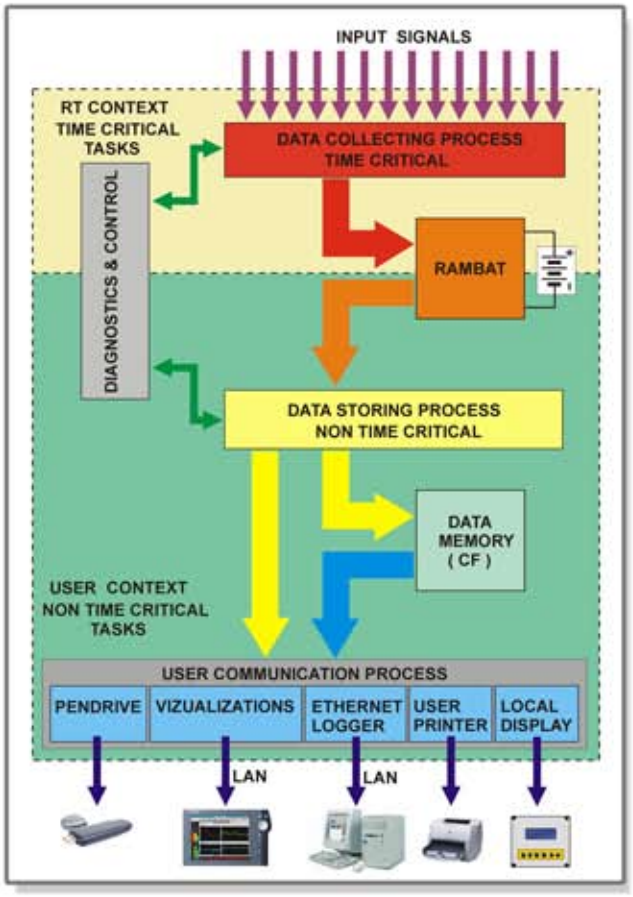

fig.5. datalogger's main program structure

The core software consists of many modules (processes). Those requiring exact time execution are run as real-time threads. Input signals are gathered within precision time intervals and stored along with their timestamps on dedicated, non-volatile memory, called RAMBAT. It is static, battery back-upped Random Access Memory, available for the system immediately on power-on. This enables the device to start main logging thread right after it powers up.

Other time-critical operations requiring real-time execution are self diagnostic threads and configuration-manages threads (controlling the way the signals are gathered). The renaming tasks being part of datalogger's, functionality aren't time critical. They operate on already stored data and it's execution may be delayed. Their functionality consists of data processing (compression), data storage on CF drive, external devices communication and user interface presentation.

Described above structure and internal data-flow rules guarantees reliable operation and secure data logging in difficult, industrial conditions. The device remains stable and the data continuous even while operating under influence of magnetic fields or unstable power supply.

Datalogger's web-server

The AR-4c datalogger has built-in web server, which enables basic management and configuration via www interface. The datalogger's web site allows user to:t

- display current signal configuration
- alter range of parameters
- data download – offers data in LOGGER readable format
- audio data download/playback
- display system diagnostic information

AR-4c datalogger deployment, periodic inspections and service.

The AR-4c datalogger's hardware and software is always configured to meet individual customer's requirements. Complete device consists of I/O cards described above, requested by user in order to retain compatibility with surrounding environment (installation).

Dedicated service software allows user (and authorized service) to configure and prepare the datalogger before deployment.

Preconfigured datalogger is tentatively programmed and parametrized by manufacturer. In the next step the device undertakes series of functional and reliability tests. Ready product, prepared according to the procedures described above may be either deployed by manufacturer's service or be prepared for customer's individual deployment.

By virtue of datalogger's application it is recommended to perform regular – at lease once a year – inspection. If the device's operation is critical for object (factory, hoist, etc.) it is recommended to perform such inspection by authorized service twice a year.

AR-4c datalogger

Technical data	
Input voltage	20V - 30V DC and 90 - 260V AC
Power consumption	up to 30VA, standard 15VA
Environment operating temperature	5 - 50°C
Environment storage temperature	-40°C - +90°C
Dimensions (default configuration i.e. without binary and analog inputs)	155 × 125 × 160 mm
Dimensions with base	200 × 125 × 160 mm
Weight	3 kg
Backup power supply (battery) operating time	4-5 hours for 2,9 Ah batteries
Sampling rate	10 Hz - 1 kHz
Quadrature counter	2
Memory capacity	4 GB - 16 GB (1 - 4 months)
Binary inputs (16 and 32 inputs cards)	
Number of binary signals logged	up to 4080
Input voltage	24V, 48V, 220V, 110V DC
Binary inputs input voltage latitude	+-35%
Input signals current	4.5 - 10mA
Izolacja galwaniczna	1000 - 2500 V
Analogue signals (8 and 16 inputs cards)	
Number of analog signal inputs	up to 32
Analog signals input voltage	-10V - +10V, -20V - +20V, -100V - +100V
Logger current range	-20mA - +20mA
Converter resolution	12bit + sign (0,2 %)
Input signals galvanic insulation	1000 - 2500 V
Analogue signals (from PLCs)	
Count	up to 255 (16 - bits words)
Resolution	16 or 32 bits
Audio inputs	
Count	4
Input voltage	max +/- 2,5V
Outputs	
Count	2
Output voltage and current	24V, 0,5A
Number of additional relay outputs	16 or 30 outputs

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