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Technical paper from Eckelmann AG, Wiesbaden

Supermarket Refrigeration at the Touch of a Screen

Control systems for refrigeration systems are getting increasingly complex, the opposite should apply to their operation. Therefore, manufacturers like Eckelmann are breaking completely new ground with their central operating and control equipment and are focusing on touch technology to make the operation of control systems as comfortable as possible.

Fig. 1: CI 4000, the new system control centre for E*LDS

The aim is optimum operation, fast and safe commissioning and maintenance of the systems. And system information, e.g. for temperature documentation, should also be made easily accessible for user groups with less experience in refrigeration technology such as store managers. In doing so, the requirements for a system control centre are high and extremely diverse because they are far more than "only" operator interfaces. As E*LDS is a system in which decentralised components take over control tasks, particularly via CAN-Bus networked case controllers and pack controllers, central tasks are delegated to a host computer. The most important central system functions include:

- Configuration and parameterisation of all system components
- Communication: internal via CAN bus and external interfaces such as Ethernet, Modbus etc.
- Archiving of operating data
- Energy and consumption data acquisition
- Load management
- Alarm management
- System diagnostics
- User administration

The unit monitors all operating data (e.g. pressures and temperatures) and optionally integrates the building automation. Service centres can perform remote maintenance on E*LDS systems using secure network connections and the CI 4000 as central access point. In this respect, it also functions

as gateway between CAN bus and Ethernet. Among other things, the CI 4000 manages two different CAN bus segments and the following other interfaces: Ethernet / LAN, 3 x RS232 / 1 x 485, 2 USB (Host & Slave). A web server is integrated. Modbus is implemented for the standardised exchange of process data with external systems. The most important innovations in operating philosophy matters are described in more detail below.

Who is allowed to do what?

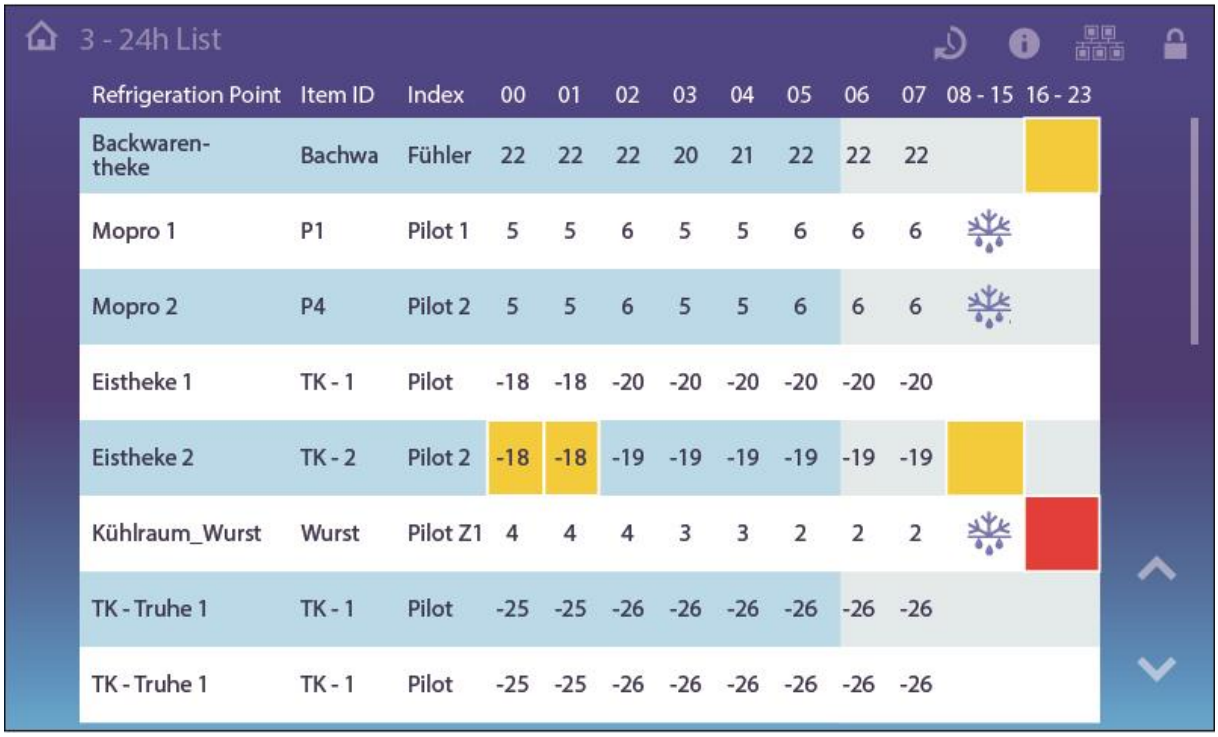
The CI 4000 clearly separates diagnostics and configuration. Specifically, this means: The configuration menu is only accessible to authorised users who must authenticate themselves by entering a password. Therefore, the corresponding button on the start screen is deactivated and displayed as greyed out in the diagnostics mode. The improved authorisation concept increases the security of E*LDS systems as unauthorised or accidental changes by unauthorised persons are largely ruled out. The CI 4000 has user management with differentiated access rights; non-critical areas and functions are freely accessible in the diagnostics mode. All logins are recorded in a log file.
On the other hand, due to the flat information architecture in the diagnostics mode, the concept provides a significantly faster way to the relevant information for them to various user groups. One example is the 24 hours temperature list which the store manager reaches with only one touch from the starting screen. On the other hand, the refrigeration engineer who logs in as Administrator can go more deeply into E*LDS via the hierarchically structured configuration menu: from the system configuration to individual E*LDS components down to the temperature sensors and pressure transmitters. Integrated DDCs for the building automation or external controllers can also be reached. Users can return to the starting screen from every screen by tapping the Home button.

Faster overview

A significant advantage in comparison with the CI 3000 is an improved overview. The system overview has comfortable list views of:

- components: pack controllers, case controllers, wireless sensor system
- connected energy and consumption meters
- timers
- SIOX expansion modules with I/O assignment
- Alarms and messages

With the new overviews, the system structure can be quickly understood or problems detected. The list view compresses the most important information for the components: this includes address, controller type, firmware version and last but not least operating status. This also enables faster diagnosis of problems and thus accelerates the search for their causes. For example, if the list of all case controllers is called up, all positions can be scrolled through in a few seconds. "Further information" shows all available information in detail, particularly the actual values and setpoints. Pending alarms and system messages can also be conveniently handled as scrolling lists. The search for and acknowledgement / reset of error messages has been significantly simplified with this for the refrigeration engineer. With 0 to 99 alarm priorities, the CI 4000 supports highly differentiated alarm management. Particularly for the integration of GLT functions in E*LDS, this enables trade-related mapping and forwarding of alarms.
For displays with many values such as the 24 hours temperature lists, accordion navigation makes the balance between very detailed information and optimum utilisation of the display area. The hourly average values for time windows of 8 hours each can be expanded. For example, it is possible in this way for the store manager to identify problematic operation states very quickly. Critical temperatures and defrost events are highlighted in colour and with icons.



Refrigeration Point	Item ID	Index	00	01	02	03	04	05	06	07	08 - 15	16 - 23
Backwaren-theke	Bachwa	Fühler	22	22	22	20	21	22	22	22		
Mopro 1	P1	Pilot 1	5	5	6	5	5	6	6	6		
Mopro 2	P4	Pilot 2	5	5	6	5	5	6	6	6		
Eistheke 1	TK - 1	Pilot	-18	-18	-20	-20	-20	-20	-20	-20		
Eistheke 2	TK - 2	Pilot 2	-18	-18	-19	-19	-19	-19	-19	-19		
Kühlraum_Wurst	Wurst	Pilot Z1	4	4	4	3	3	2	2	2		
TK - Truhe 1	TK - 1	Pilot	-25	-25	-26	-26	-26	-26	-26	-26		
TK - Truhe 1	TK - 1	Pilot	-25	-25	-26	-26	-26	-26	-26	-26		

Fig. 2: 24 hours temperature list with defrost events and temperature alarms.

The display of operating data in the form of diagrams enables intuitive comprehension of temperature or energy consumption profiles. The CI 4000 also provides options for the integration of system visualisation. Up to now, only the comprehensive LDSWin PC configuration tool or the web service LDSWeb provided a comparable clear overview. It is planned for the future that the store manager will also be able to call up the user interface of the CI 4000 as web interface directly in his browser.

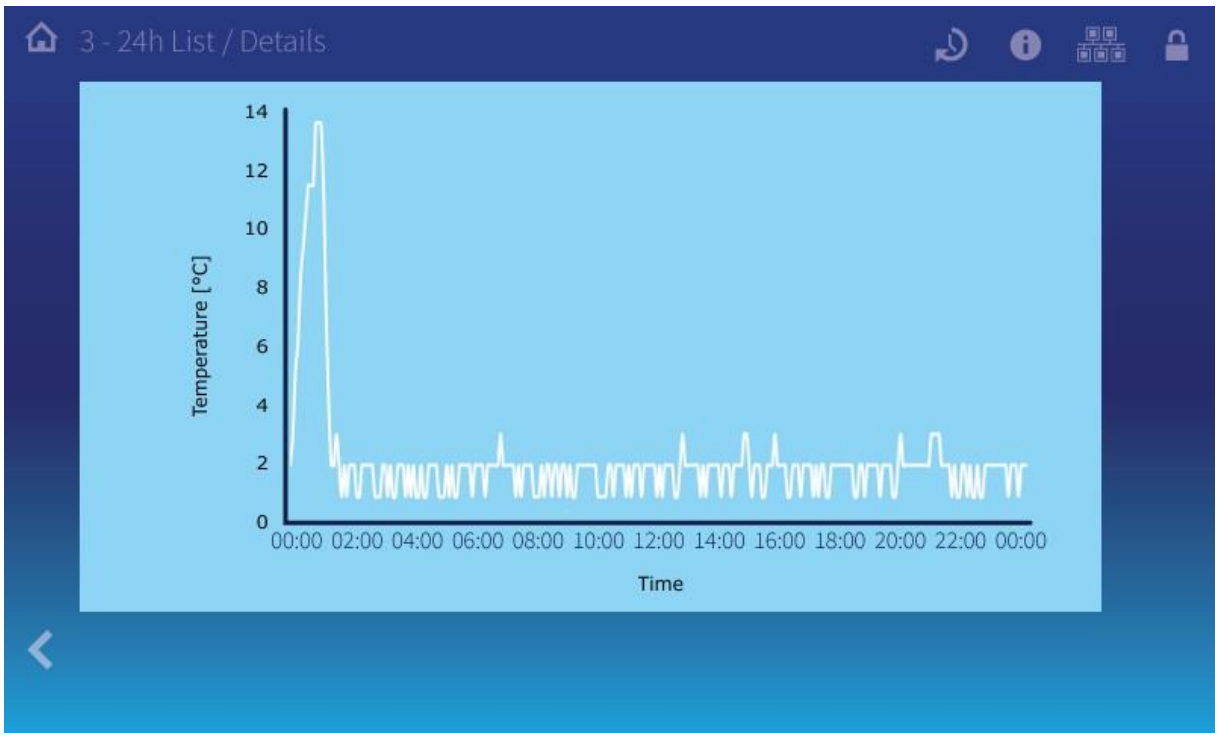


Fig. 3: Graphical display of a temperature profile.

Improved input

The touch screen of the CI 4000 means a completely new user interface. As compared with a line display with numeric block foil keypad as with the CI 3000, the operation has become significantly more intuitive and considerably fewer steps are necessary for the same tasks. The CI 4000 displays a virtual keyboard for the input of values or text. And if the context only allows numeric values, a numeric keypad is displayed, with required special characters if necessary. The virtual keyboard is used for example in the formulas for the configuration for individual components.
The direct comparison makes the advantage clear: While every value had to be selected and edited individually for the CI 3000, several parameters can now be adjusted and transferred en bloc. For some fields, a drop-down selection box with possible values is available. This is not only quicker, but also minimises incorrect entries. Configuration parameters have been summarised in one screen where they are required.
These are only some examples of the improved usability. The developer team at Eckelmann has paid a lot of attention to the overall interaction design because it is only with really well thought out and intuitive user interfaces that the strengths of the touch screen technology can be used efficiently.
Using the so-called terminal mode, remote operation of the individual components is possible for the CI 4000; the interface of the CI 3000 has been emulated virtually on the CI 4000 for this. Thereby, the system control centre becomes quasi an extended "workbench" and replaces separate operator interfaces.

USB as service interface

The CI 4000 has practical USB ports (Host & Slave) for service use. The notebook with LDSWin can be easily connected using these; particularly as serial interfaces are no longer installed on many current notebooks which made cumbersome adapter solutions necessary in the past.

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Brochure for CI 4000:
http://www.eckelmann.de/fileadmin/user_upload/downloads/Kaeltetechnik/EN/Brochure_CI4000_EN.pdf
Data sheet for CI 4000:
http://www.eckelmann.de/fileadmin/user_upload/downloads/Kaeltetechnik/EN/E_LDS_CI4000_EN.pdf

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