**Instruction**

Actuator

ICAD 600 / ICAD 900 / ICAD 1200

---

**Fig. 1**

ICAD 600  
ICAD 900  
ICAD 1200

**Fig. 2**

ICAD 600  
ICAD 900  
ICAD 1200

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**Note:** When mounting the ICAD make sure to push ICAD down to mechanical stop.

**Fig. 3**

- Nm
- LB-feet

<table>
<thead>
<tr>
<th>Nm</th>
<th>LB-feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2.5</td>
</tr>
</tbody>
</table>

**Fig. 4**

- mm  
- in.

<table>
<thead>
<tr>
<th>H</th>
<th>45</th>
<th>1.77</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>25</td>
<td>1</td>
</tr>
</tbody>
</table>

**Fig. 5a, ICM + ICAD 600**

**Fig. 5b, ICM + ICAD 900**

**Fig. 5c, ICM + ICAD 1200**
ICAD 600/900/1200

<table>
<thead>
<tr>
<th>Reference</th>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Black</td>
<td>– Common Alarm</td>
</tr>
<tr>
<td>B</td>
<td>Brown</td>
<td>– ICM fully open</td>
</tr>
<tr>
<td>C</td>
<td>Red</td>
<td>– ICM fully closed</td>
</tr>
<tr>
<td>D</td>
<td>Orange</td>
<td>– GND ground</td>
</tr>
<tr>
<td>E</td>
<td>Yellow</td>
<td>+ 0/4 - 20 mA Input</td>
</tr>
<tr>
<td>F</td>
<td>Green</td>
<td>+ 0/2 - 10 V Input</td>
</tr>
<tr>
<td>G</td>
<td>Blue</td>
<td>+ 0/4 - 20 mA Output</td>
</tr>
<tr>
<td>I</td>
<td>Black</td>
<td>+ Fail safe supply</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Battery / UPS* 19 V d.c.</td>
</tr>
<tr>
<td>II</td>
<td>White</td>
<td>+ Supply voltage 24 V d.c.</td>
</tr>
<tr>
<td>III</td>
<td>Brown</td>
<td>–</td>
</tr>
</tbody>
</table>

* Uninterruptible Power Supply

**Fig. 6**

**ICAD 600/900/1200 - Analog I/O for modulating control**

**Fig. 7**

**ICAD 600/900/1200 - Digital I/O for ON/OFF valve operation**

**Fig. 8**
**Electrical data**

Supply voltage is galvanically isolated from in-/output.

**Supply voltage**
- 24 V d.c., +10% / -15%
- Load ICAD 600: 1.2 A
- Load ICAD 900: 2.0 A
- Load ICAD 1200: 3.0 A

**Fail safe supply**
- Min. 19 V d.c.
- Load ICAD 600: 1.2 A
- Load ICAD 900: 2.0 A
- Load ICAD 1200: 3.0 A

**Analog input - Current or Voltage**

- Current
  - 0/4 - 20 mA
  - Load: 200 Ω
- Voltage
  - 0/2 - 10 V d.c.
  - Load: 10 kΩ

**Analog output**
- 0/4 - 20 mA
- Load: ≤ 250 Ω

**Digital input - Digital ON/OFF input by means of voltfree contact (Signal/Telecom relays with gold-plated contacts recommended)**
- Voltage input used
  - ON: contact impedance < 50 Ω
  - OFF: contact impedance > 100 kΩ

**Digital output - 3 pcs. NPN transistor output**

- External supply: 5 - 24 V d.c. (same supply as for ICAD can be used, but please note that the galvanically isolated system will then be spoiled).
- Output load: 50 Ω
- Load: Max. 50 mA

**Temperature range (ambient)**
- −30°C / +50°C (−22°F / 122°F)

**Enclosure**
- IP 67 (~NEMA 6)

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**Cable connection**

Two 1.5 m (60 in.) cables delivered together with the ICAD.

**Supply cable**

- 3 x 0.34 mm² (3 x ~22 AWG) (fig. 6)
- I: Black (+) 19 - 24 V d.c. fail safe supply (optional).
- II: White (+) 24 V d.c.
- III: Brown (−) 24 V d.c.

**Control cable**

- 7 x 0.25 mm² (7 x ~24 AWG) (fig. 7)
- A: Black (−) Digital output.
- B: Brown (−) Digital output.
- C: Red (−) Digital output.
- D: Orange (−) GND - Ground.
- E: Yellow (+) Analog input 0/4-20 mA.
- F: Green (+) Analog input 0/2-10 V / Digital ON/OFF input.
- G: Blue (+) Analog output 0/4-20 mA.

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**Electrical installation**

General procedure for ICAD 600/900/1200 installed on all ICM valves.

All necessary electrical connections to be made. Analog or digital operation of ICM valve.

**Fig. 6**

- **Analog operation** - 7 wired cable (A-G)
  - Modulation control. ICM valve to be controlled from Danfoss electronics, type EKC (fig. 7), or third party electronics (like e.g. PLC).
  - Connect analog input signals. Current (mA) or Voltage (V). See Parameter list for configuration of analog input signals.
  - Yellow (+) and Orange (GND) are used for current (mA) input.
  - Green (+) and Orange (GND) are used for Voltage (V) input.
  - Blue (+) and Orange (GND) are used for current (mA) output (optional, not mandatory).

- **Digital operation** - 7 wired cable (A-G)
  - ON/OFF ICM solenoid valve operation.
  - ICM valve to be controlled by means of a digital voltfree contact.
  - Connect digital input signals. See Parameter list for configuration of digital input signals.
  - Black (−) and Orange (GND) are connected to an auxiliary relay for Common Alarm.
  - Brown (−) and Orange (GND) are connected to an auxiliary relay indicating ICM fully open.
  - Red (−) and Orange (GND) are connected to an auxiliary relay indicating ICM fully closed.

- **Supply voltage** - 3 wired cable (I, II, III)
  - ICAD must be connected to a normal 24 V d.c. supply. As an option, a fail safe supply is possible by means of a battery or UPS (Uninterruptible Power Supply). When voltage is applied as described below, ICAD is ready to be configured. See Parameter list. ICAD configuration can be done independently whether the ICAD is installed on the ICM valve or not. See Mechanical installation.

- Connect the White (+) and Brown (−) to a 24 V d.c. supply voltage (fig. 6).

Fail safe supply as an option (not mandatory).

- Connect the Black (+) and Brown (−) to a fail safe supply.

**Mechanical installation**

General procedure for ICAD 600/900/1200 installed on all ICM valves (fig. 3).

- Check that the three socket set screws are fully unscrewed counter clockwise with a 2.5 mm Hexagon key.
- Mount ICAD by slowly lowering it on top of the ICM valve.
- The magnet coupling will drag the ICM and ICAD together and in position.
- Push ICAD in place.
- Fasten ICM and ICAD with the three socket set screws using a 2.5 mm Hexagon key.

**Startup**

When voltage is applied for the first time the display on the ICAD (fig. 2) will alternate between showing: Actual opening degree and A1.

**% Open**

A1 indicates an alarm which corresponds to: No ICM valve selected. See Alarms for further information.

**Special moisture seal is damaged if screws are removed (fig. 3, pos. A)**

Please observe that when the correct ICM valve is entered in parameter p26 (see p. 10 for Parameter list) an automatic calibration is carried out. If it is not necessary to carry out another calibration in parameter p05.

See Parameter list to select the correct.
General Operation
ICAD is equipped with an MMI (Man Machine Interface) from which it is possible to see and change different parameters to adapt the ICAD and the corresponding ICM to the actual refrigeration application. The operation of parameters is done by means of the integrated ICAD MMI (fig. 2) and consists of:

- **Down arrow push button** (fig. 2, pos. 1) decreases parameter number by 1 for each activation
- **Enter push button** (fig. 2, pos. 2) gives access to the Parameter list by keeping the push button activated for 2 seconds. A Parameter list is shown below (parameter ¡08):
  - Gives access to change a value once the Parameter list has been accessed.
  - Acknowledge and save change of value of a parameter.
  - To exit from the Parameter list and return to the display of Opening Degree (OD) keep the push button activated for 2 seconds.
- **Up arrow push button** (fig. 2, pos. 3) increases parameter number by 1 for each activation
- **Display** (fig. 2, pos. 4)
  - Normally the Opening Degree (OD) 0 - 100 % of the ICM valve is displayed. No activation of push buttons for 20 seconds means that the display will always show OD. Like below:
  - Displays the parameter
  - Displays the actual value of a parameter.
  - Displays the status by means of text (fig. 2, pos. 4)
  - **Mod** represents that ICAD is positioning the ICM valve according to an analog input signal (Current or Voltage).
  - **Low** represents that ICAD is operating the ICM valve like an ON/OFF solenoid valve with low speed according to a digital input signal.
  - **Med** represents that ICAD is operating the ICM valve like an ON/OFF solenoid valve with medium speed according to a digital input signal.
  - **High** represents that ICAD is operating the ICM valve like an ON/OFF solenoid valve with high speed according to a digital input signal. Like below:

### Alarms
ICAD can handle and display different alarms.

<table>
<thead>
<tr>
<th>Description</th>
<th>ICV alarm text</th>
<th>Definition of event</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Valve type selected</td>
<td>A1 Alarm ON</td>
<td>At start-up A1 will be displayed</td>
<td></td>
</tr>
<tr>
<td>Controller fault</td>
<td>A2 Alarm ON</td>
<td>Internal fault inside electronics</td>
<td></td>
</tr>
<tr>
<td>AI input error</td>
<td>A3 Alarm ON</td>
<td>Not active if ¡01 = 2, or ¡02 = 2 When ¡03 = 1 and AI A &gt; 22 mA When ¡03 = 2 and AI A &gt; 22 mA or AI A &lt; 2 mA When ¡03 = 3 and AI A &gt; 12 V When ¡03 = 4 and AI A &gt; 12 V or AI A &lt; 1 V</td>
<td></td>
</tr>
<tr>
<td>Low voltage of fail safe supply</td>
<td>A4 Alarm ON</td>
<td>If 5 V &lt; fail safe supply &lt;18 V. Enabled by ¡08</td>
<td></td>
</tr>
<tr>
<td>Check supply to ICAD</td>
<td>A5 Alarm ON</td>
<td>If supply voltage &lt; 18 V</td>
<td></td>
</tr>
<tr>
<td>Calibration extended failed</td>
<td>A6 Alarm ON</td>
<td>Check valve type selected, Check presence of foreign body internally in ICM valve</td>
<td></td>
</tr>
<tr>
<td>Thermal overload</td>
<td>A8 Alarm ON</td>
<td>ICAD stepper motor temperature to high</td>
<td></td>
</tr>
<tr>
<td>Valve locked</td>
<td>A9 Alarm ON</td>
<td>If the valve is locked in more than 1 minute.</td>
<td></td>
</tr>
</tbody>
</table>

If an alarm has been detected the display at ICAD (fig. 2) will alternate between showing actual alarm and present Opening Degree.

If more than one alarm is active at the same time only the alarm with the highest priority will appear. A1 has the highest priority, A5 the lowest.

Any active alarm will activate the Common Digital Alarm output (Normally Open).

All alarms will automatically reset themselves when they physically disappear.

Old alarms (alarms that have been active, but have physically disappeared again) can be found in parameter ¡11.

### Disposal Note
The Product contains electrical components and may not be disposed together with domestic waste.

Equipment must be separate collected with Electrical and Electronic waste. According to Local and currently valid legislation.
<table>
<thead>
<tr>
<th>Description</th>
<th>ICV Name</th>
<th>Min</th>
<th>Max</th>
<th>Factory Setting</th>
<th>Stored</th>
<th>Unit</th>
<th>Pass word</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>OD (Opening degree)</td>
<td></td>
<td>-</td>
<td>100</td>
<td>%</td>
<td>-</td>
<td></td>
<td></td>
<td>ICM valve Opening Degree is displayed during normal operation. Running display value (see (\emptyset_1), (\emptyset_5)).</td>
</tr>
<tr>
<td>Main Switch (\emptyset_1)</td>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>No</td>
<td></td>
<td>Internal main switch 1: Normal operation 2: Manual operation. Valve Opening Degree will be flashing. With the down arrow and the up arrow push buttons the OD can be entered manually.</td>
</tr>
<tr>
<td>Mode</td>
<td>(\emptyset_2)</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>No</td>
<td></td>
<td>Operation mode 1: Modulating – ICM positioning according to Analog Input (see (\emptyset_3)) 2: ON/OFF - operating the ICM valve like an ON/OFF solenoid valve controlled via Digital Input. See also (\emptyset_9).</td>
</tr>
<tr>
<td>AI signal (\emptyset_3)</td>
<td></td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>-</td>
<td>No</td>
<td></td>
<td>Type of AI signal from external controller 1: 0-20 mA 2: 4-20 mA 3: 0-10 V 4: 2-10 V</td>
</tr>
<tr>
<td>Speed</td>
<td>(\emptyset_4)</td>
<td>1</td>
<td>100</td>
<td>50/100</td>
<td>-</td>
<td>No</td>
<td></td>
<td>Speed can be decreased. Max. speed is 100 % Not active in manual operation (\emptyset_1 = 2) If (\emptyset_26 = 1 - 3) then factory setting = 100 If (\emptyset_26 = 4 - 9) then factory setting = 50 If ICM is opening and ((\emptyset_04 &lt; = 33)) or ICM is closing and ((\emptyset_14 &lt; = 33)) (\Rightarrow) Low is displayed. If ICM is opening and (33 &lt; If (\emptyset_04 &lt; = 66)) or ICM is closing and (33 &lt; If (\emptyset_14 &lt; = 66)) (\Rightarrow) Med is displayed. If ICM is opening and ((\emptyset_04 = 67)) or ICM is closing and ((\emptyset_14 &gt; = 67)) (\Rightarrow) High is displayed&quot;</td>
</tr>
<tr>
<td>Automatic calibration (\emptyset_5)</td>
<td></td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>-</td>
<td>No</td>
<td></td>
<td>Not active before (\emptyset_26) has been operated. Always auto reset to 0. CA will flash in the display during calibration, if Enter push button has been activated for two seconds 0: No Calibration 1: Normal forced calibration - CA flashing slowly 2: Extended calibration – CA flashing rapidly&quot;</td>
</tr>
<tr>
<td>AO signal (\emptyset_6)</td>
<td></td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>No</td>
<td></td>
<td>Type of AO signal for ICV valve position 0: No signal 1: 0-20 mA 2: 4-20 mA</td>
</tr>
<tr>
<td>Failsafe (\emptyset_7)</td>
<td></td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>No</td>
<td></td>
<td>Define condition at power cut and battery is installed. 1: Close valve 2: Open Valve 3: Maintain valve position 4: Go to OD given by (\emptyset_12)</td>
</tr>
<tr>
<td>Fail safe supply (\emptyset_8)</td>
<td></td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>-</td>
<td>No</td>
<td></td>
<td>Enables the A4 fail safe supply error alarm.</td>
</tr>
<tr>
<td>DI function (\emptyset_9)</td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
<td>-</td>
<td>No</td>
<td></td>
<td>Define function when DI is ON (short circuited DI terminals) when (\emptyset_2 = 2) 1: Open ICM valve (DI = OFF = &gt; Close ICM valve) 2: Close ICM valve (DI = OFF = &gt; Open ICM valve)</td>
</tr>
<tr>
<td>Password (\emptyset_{10})</td>
<td></td>
<td>0</td>
<td>199</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td></td>
<td>Enter number to access password protected parameters: (\emptyset_6) Password = 11</td>
</tr>
<tr>
<td>Old Alarms (\emptyset_{11})</td>
<td></td>
<td>A1</td>
<td>A99</td>
<td>-</td>
<td>-</td>
<td>No</td>
<td></td>
<td>Old alarms will be listed with the latest shown first. Alarm list can be reset by means of activating down arrow and up arrow at the same time for 2 seconds.</td>
</tr>
<tr>
<td>OD at power cut. (\emptyset_{12})</td>
<td></td>
<td>0</td>
<td>100</td>
<td>50</td>
<td>-</td>
<td>No</td>
<td></td>
<td>Only active if (\emptyset_7 = 4) If fail safe supply is connected and power cut occurs, the ICM will go to the specified OD.</td>
</tr>
<tr>
<td>Inverse operation (\emptyset_{13})</td>
<td></td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>-</td>
<td>No</td>
<td></td>
<td>0: Increasing Analog Input signal =&gt; Increasing ICM Opening Degree 1: Increasing Analog Input signal =&gt; Decreasing ICM Opening Degree</td>
</tr>
<tr>
<td>In ON/OFF Mode Closing speed (\emptyset_{14})</td>
<td></td>
<td>0</td>
<td>100</td>
<td>50/100</td>
<td>-</td>
<td>No</td>
<td></td>
<td>See (\emptyset_4). If (\emptyset_26 = 1 - 3) then factory setting = 100 If (\emptyset_26 = 4 - 9) then factory setting = 50</td>
</tr>
<tr>
<td>Manual set point (\emptyset_{15})</td>
<td></td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>-</td>
<td>No</td>
<td></td>
<td>When (\emptyset_1 = 2), (\emptyset_15) determine the start up value.</td>
</tr>
<tr>
<td>Encoder operation (\emptyset_{16})</td>
<td></td>
<td>0</td>
<td>1</td>
<td>0/1</td>
<td>Yes/</td>
<td>-</td>
<td></td>
<td>NB: Password protected. Password = 11</td>
</tr>
<tr>
<td>ICM Configuration (\emptyset_{26})</td>
<td></td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>Yes/</td>
<td>-</td>
<td></td>
<td>NB: Password protected. Password = 11 0: No valve selected. Alarm A1 will become active. 1: ICM 20 with ICAD 600 2: ICM 25 with ICAD 600 3: ICM 32 with ICAD 600 4: ICM 40 with ICAD 900/1200 5: ICM 50 with ICAD 900/1200 6: ICM 65 with ICAD 900/1200 7: ICM 100 with ICAD 1200 8: ICM 125 with ICAD 1200 9: ICM 150 with ICAD 1200</td>
</tr>
<tr>
<td>Description</td>
<td>ICV Name</td>
<td>Min</td>
<td>Max</td>
<td>Factory Setting</td>
<td>Stored</td>
<td>Unit</td>
<td>Pass word</td>
<td>Comments</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------</td>
<td>-----</td>
<td>-----</td>
<td>-----------------</td>
<td>--------</td>
<td>------</td>
<td>-----------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>OD %</td>
<td></td>
<td>0</td>
<td>100</td>
<td>-</td>
<td>%</td>
<td>-</td>
<td>-</td>
<td>ICM valve Opening Degree</td>
</tr>
<tr>
<td>AI [mA]</td>
<td></td>
<td>51</td>
<td>100</td>
<td>-</td>
<td>mA</td>
<td>-</td>
<td>-</td>
<td>AI signal</td>
</tr>
<tr>
<td>AI [V]</td>
<td></td>
<td>52</td>
<td>100</td>
<td>-</td>
<td>V</td>
<td>-</td>
<td>-</td>
<td>AI signal</td>
</tr>
<tr>
<td>AO [mA]</td>
<td></td>
<td>53</td>
<td>100</td>
<td>-</td>
<td>mA</td>
<td>-</td>
<td>-</td>
<td>AO signal</td>
</tr>
<tr>
<td>DI</td>
<td></td>
<td>54</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>DI signal. Depending of 02 and 09.</td>
</tr>
<tr>
<td>DO Close</td>
<td></td>
<td>55</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>DO Closed status. ON when OD &lt; 3 %</td>
</tr>
<tr>
<td>DO Open</td>
<td></td>
<td>56</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>DO Open status. ON when OD &gt; 97 %</td>
</tr>
<tr>
<td>DO Alarm</td>
<td></td>
<td>57</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>DO alarm status. ON when a Alarm is detected</td>
</tr>
<tr>
<td>Display mP SW ver.</td>
<td></td>
<td>58</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Software version for display microprocessor</td>
</tr>
<tr>
<td>Motor mP SW ver.</td>
<td></td>
<td>59</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Software version for motor microprocessor</td>
</tr>
</tbody>
</table>

**Reset to factory setting:**
1. Remove the power supply.
2. Activate down arrow and up arrow push buttons at the same time.
3. Connect the power supply.
4. Release down arrow and up arrow push buttons.
5. When the display on ICAD (fig. 2) is alternating between showing: **CA** and **A1** the factory resetting is complete.
DECLARATION OF CONFORMITY

Name and Address of Manufacturer within the European Community
Danfoss Industrial Refrigeration
Stormosevej 10
DK-8361 Hasselager
Denmark

Declaration
We hereby declare that below-mentioned equipment is in conformity with below mention directives, standards or other normative documents, provided it is used according to our instructions.

Description of Equipment
Actuator for ICM valves
Type ICAD 600 / ICAD 900 / 1200

References of other Technical Standards and Specifications used
CE according to 89/336 EEC (EMC)
Emission: EN61000-6-3
Immunity: EN61000-6-2

Authorised Person for the Manufacturer within the European Community
Name: Claus Schou Nielsen
Title: Director, Operations
Signature: [Signature]
Date: 01/09/2009