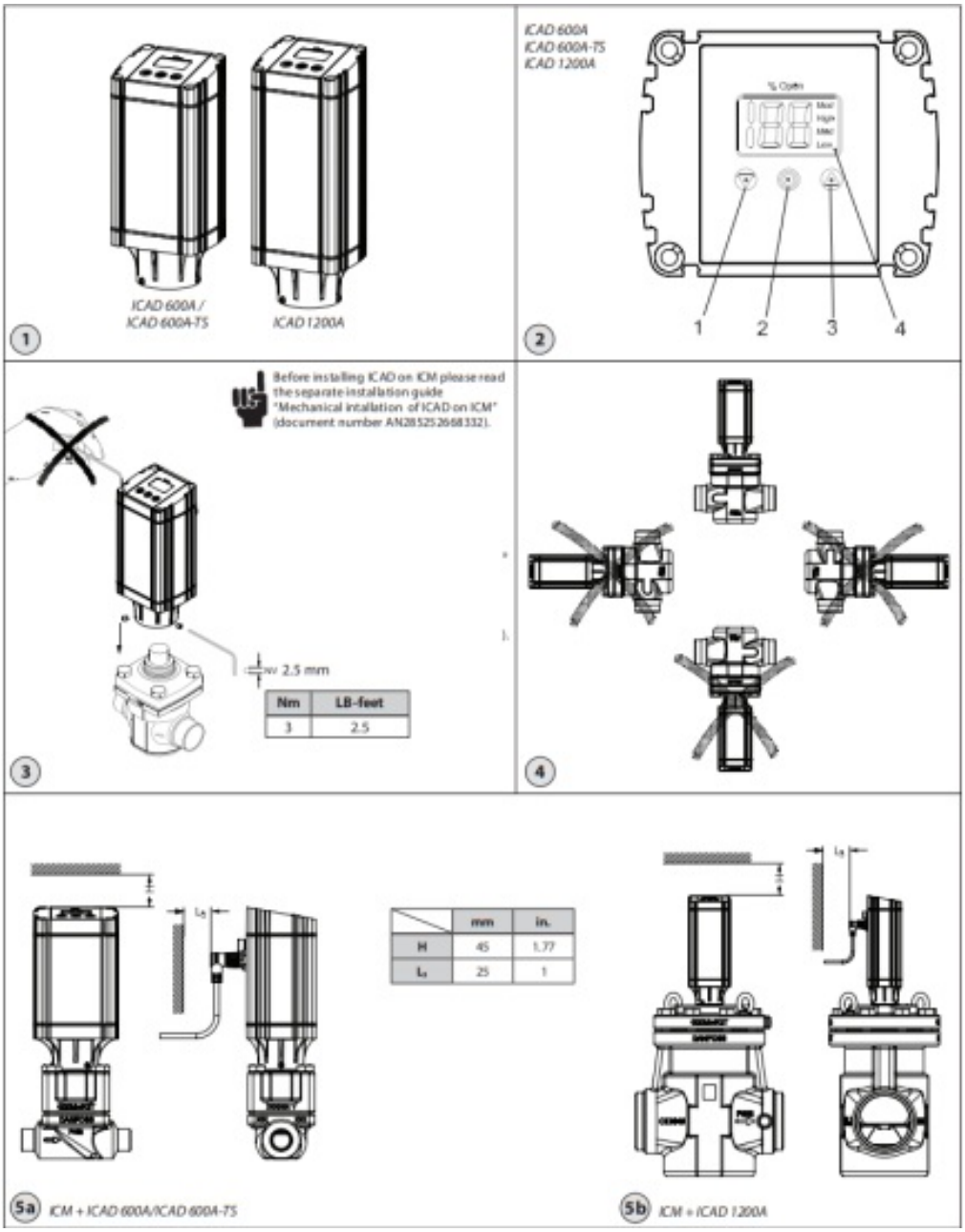
Danfoss ICAD 600A Motor Actuator with Standard Installation Guide

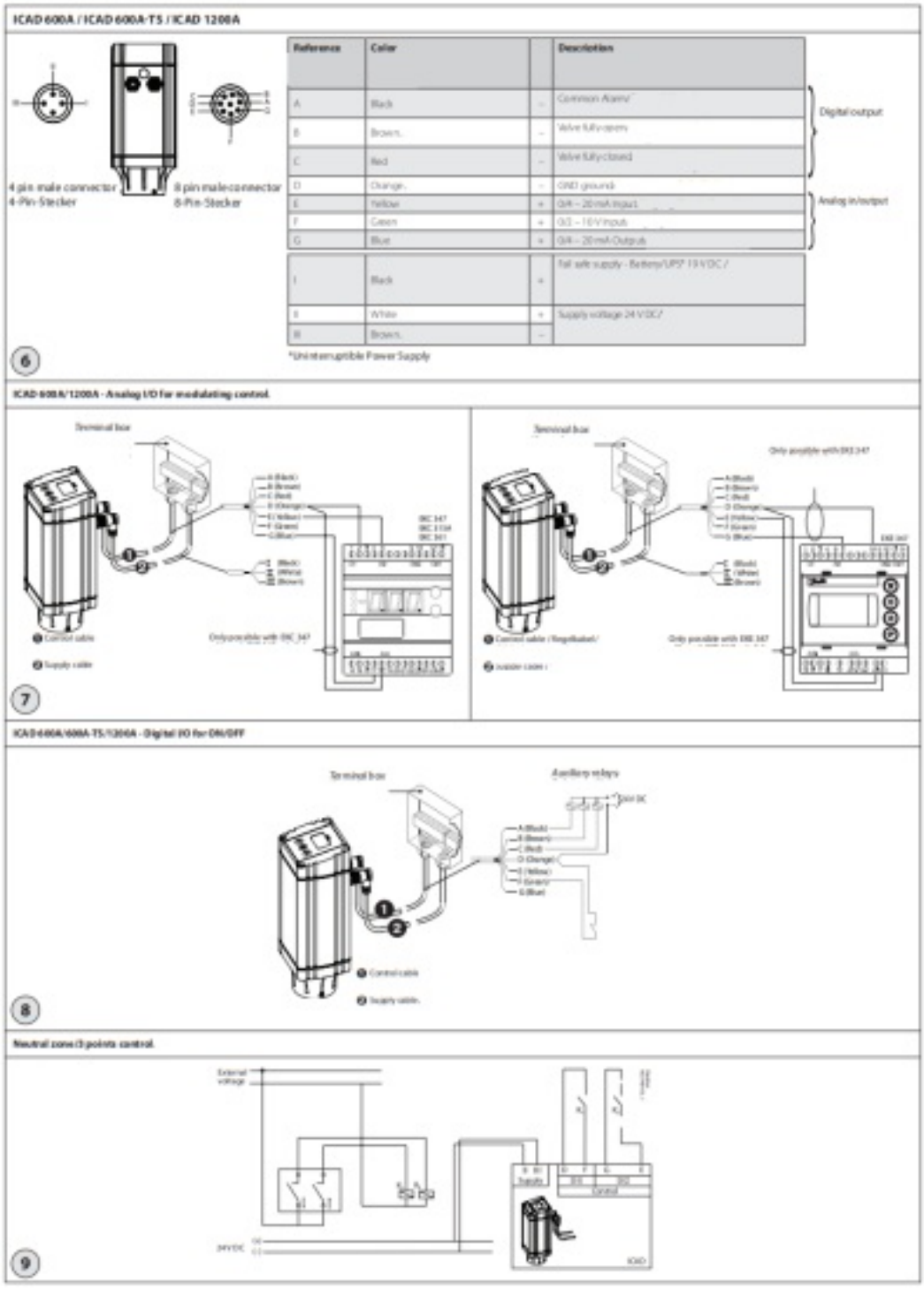
ENGINEERING TOMORROW
Installation guide
Actuator

089

Contents

Type ICAD 600A / ICAD 600A-TS / ICAD 1200A


ICAD 600A /
ICAD 600A-TS
ICAD 1200A
1
ICAD 600A
ICAD 600A-TS
ICAD 1200A
% Cont
Max
High
Med
Low
1
2
3
4
2
Before installing ICAD on ICM please read the separate installation guide "Mechanical intallation of ICAD on ICM" (document number AN285252668332).
2.5 mm
Nm
LB-feet
3
2.5
3
4
mm
in.
H
45
1.77
L_4
25
1
5a
ICM + ICAD 600A/ICAD 600A-TS
5b
ICM + ICAD 1200A



Installation

Do not install ICAD before welding. This apply for electrical as well as for mechanical installation. Please observe that ICAD when connected to 24 V DC, will send out acoustic noise at stand still. This has no influence on the function/ operation of the ICAD.

NOTE!
If media temperature is lower than -30 °C (-22 °F) it is mandatory to set parameter ¡30 and ¡31.
See separate document attached in ICAD box: document number AN285243155312

Use
ICAD 600A, ICAD 600A-TS and ICAD 1200A can be used together with the following Danfoss valves (fig. 1, 5a and 5b).

ICAD 600A	ICAD 600A-TS	ICAD 1200A
ICM 20	ICMTS 20	ICM 40
ICM 25	ICMTS 50	ICM 50
ICM 32	ICMTS 80	ICM 65
		ICM 100
		ICM 125
		ICM 150
		CVE pilot valve

Electrical data
Supply voltage is galvanically isolated from in-/output.
Supply voltage
24 V DC (Tolerances; see below table)
Load ICAD 600A, ICAD 600A-TS: 1.2 A
ICAD 1200A: 2.0 A

24 Volt DC ONLY

Please observe cable voltage drop.
Distance between the applied DC transformer and the ICAD terminal box may cause a voltage drop. Cross section of cables and size of DC transformer must be calculated so that the voltage at all time at the ICAD terminal box*, both during standstill and during operation of ICAD, is within this range:

Prefabricated ICAD cable length Code number		**1.5 m 027H0426**	**3 m 027H0438**	**10 m 027H0427**	**15 m 027H0435**
Voltage ICAD terminal (600A/1200A) [V DC]	Min.	21	22	23	24
	Max.		26.4		

* Do not measure inside the ICAD itself.

Fail safe supply
24 V DC (Tolerances; see table above)
Load ICAD 600A, ICAD 600A-TS: 1.2 A
ICAD 1200A: 2.0 A
Anolog Input – Current or Voltage
Current
0/4 – 20 mA
Load: 200 W
Voltage
0/2 – 10 V DC
Load: 10 k W
Analog Output
0/4 – 20 mA
Load: ≤ 250 W
Digital Input – Digital ON/OFF input by means of voltfree contact (Signal/Telecom relays with goldplated contacts recommended) – Voltage input used
ON: Contact impedance < 50 W)
OFF: Contact impedance > 100 kΩ

Digital Output – 3 pcs. NPN transistor output
External supply: 5 – 24 V DC (same supply as for ICAD can be used, but please note that the galvanically isolated system will then be spoiled).
Output load: 50 W
Load: Max. 50 mA

Temperature range (ambient)

-30 °C/+50 °C (-22 °F/122 °F)

Enclosure

IP67 (~NEMA 6)

Electrical connection

Connection to ICAD is done via M12 connectors.
ICAD has two M12 male connectors build-in:
Power supply: 4 poled M12 male connector Control signals: 8 poled M12 male connector
If ICAD is delivered with cables (1.5 m. (60 in.))
M12 female connectors: (Cable set with M12 female connectors in other lengths are available)
Power Supply cable with 4 poled M12 female connector
3 x 0.34 mm²
(3 x ~22 AWG) (fig. 6)
I: Black (+) 19 – 24 V DC fail safe supply (optional).
II: White (+) 24 V DC
III: Brown (–) 24 V DC
Control cable with 8 poled M12 female connector
7 x 0.25 mm²
(7 x ~24 AWG) (fig. 7)
A: Black (–) Digital output.
Common Alarm.
B: Brown (–) Digital output.
ICM fully open.
C: Red
(–) Digital output.
ICM fully closed.
D: Orange (–) GND – Ground.
E: Yellow (+) Analog input
0/4 – 20 mA. *)
F: Green (+) Analog input 0/2 – 10 V /
DI1 – Digital ON/OFF input.
G: Blue (+) Analog output 0/4 – 20 mA. *)
*) If Neutral zone / 3 point control is selected (parameter i02 = 3) then E and G is used as DI2 – Digital ON/OFF input. Se fig. 9.

Electrical installation

General procedure for ICAD 600A/ICAD 600A-TS/1200A installed on all ICM, ICMTS & CVE valves.
All necessary electrical connections to be made.

ICM valve: Analog or digital operation CVE/ICMTS valve: Analog only

Fig. 6

Analog operation – 7 wired cable (A-G) Modulation control. Valve to be controlled from Danfoss electronics, type EKC/EKE (fig.7), or third party electronics (like e.g. PLC).

- Connect analog input signals. Currrent (mA) or Voltage (V). See Parameter list for configuration of analog input signals.
- Yellow (+) and Orange (GND) are used for current (mA) input.

  or
- Green (+) and Orange (GND) are used for Voltage (V) input.
- Blue (+) and Orange (GND) are used for current (mA) output (optional, notmandatory).

Fig. 6

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 (fig. 8). See Parameter list for configuration of digital input signals.

- Green (+) and Orange (GND) are connected to a voltfree contact.

  Digital output signals are optional, not mandatory.
- Black (–) and Orange (GND) are connected to 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 DC 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 configurated. See Parameter list. ICAD configuration can be done independently whether the ICAD is installed on the valve or not. See Mechanical installation.
– Connect the White (+) and Brown (–) to a 24 V DC 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 600A/ICAD 600A-TS/1200A installed on all 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 valve.
- The magnet coupling will drag the valve and ICAD together and in position.
- Push ICAD in place.
- Fasten valve and ICAD with the three socket set screws using a 2.5 mm Hexagon key.

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

Neutral zone / 3 point control (fig. 9 – ICM only)

¡02 = 3

When ¡02 = 3 the factory setting of ¡04 (opening) and ¡14 (closing) are both set to 10. When ¡02 = 3 the speed given by ¡04 (opening) and ¡14 (closing) are active

¡13 (Inverse operation) is active

¡16 = 1 (Encoder operation enable) is active.

¡**13** = 0 (Direct operation)

DI1 = DI2 = OFF

ICAD/ICM maintain current position

DI1 = DI2 = ON

ICAD/ICM maintain current position

DI1 = ON, DI2 = OFF

ICAD increase opening degree

DI1 = OFF, DI2 = ON

ICAD decrease opening degree

¡13 = 1 (Inverse operation)

DI1 = DI2 = OFF

ICAD maintain current position

DI1 = DI2=ON

ICAD maintain current position

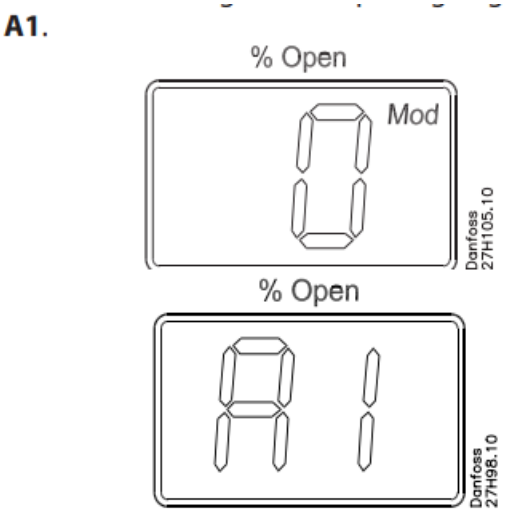
DI1 = ON, DI2 = OFF

ICAD decrease opening degree

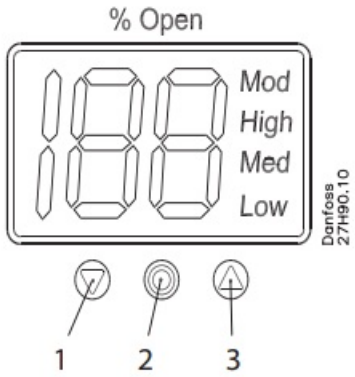
DI1 = OFF, DI2 = ON

ICAD increase opening degree

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

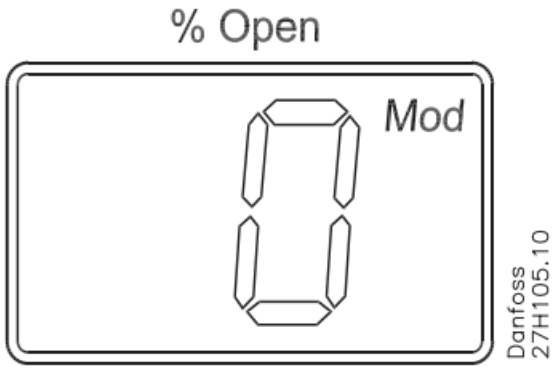


A1 indicates an alarm which corresponds to: No valve selected. See Alarms for further information.
Please observe that when the correct valve is entered in parameter ¡26 (see Parameter list) an automatic calibration is carried out. I.e it is not necessary to carry out another calibration in parameter ¡05.
During calibration “CA” will be flashing in the display.
The ICAD will briefly display “CS” every time the valve is going to close and reach 0%.
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 valve 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.

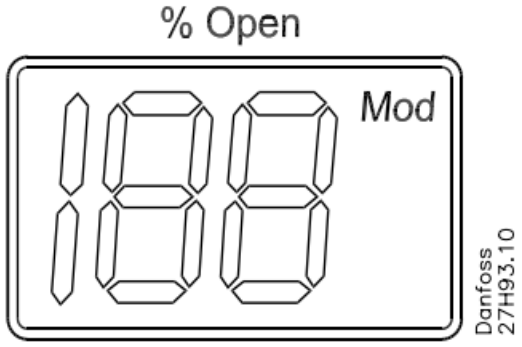
– To exit from the Parameter list and return to the display of Opening Degree (OD) keep the push button activated for 2 seconds.

- 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 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.

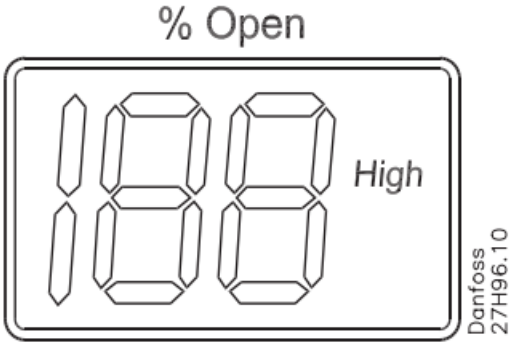
- Displays the status by means of text (fig. 2, pos. 4).

  – Mod represents that ICAD is positioning the ICM, ICMTS or CVE 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.

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, A9 the lowest.

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

All alarms will automatically reset them-selves 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.

Description	ICAD alarm text	Definition of event	Comments
No Valve type selected	**A1**	Alarm ON	At start-up **A1** will be displayed
Controller fault	**A2**	Alarm ON	Internal fault inside electronics. Carry out: 1) Power OFF and Power ON If A2 still active. 2) Make a Reset to factory setting If A2 still active. Return ICAD to Danfoss
AI input error	**A3**	Alarm ON	Not active if **¡01** = 2, or **¡02** = 2 When **¡03** = 1 and AI A > 22 mA When **¡03** = 2 and AI A > 22 mA or AI A < 2 mA When **¡03** = 3 and AI A > 12 V When **¡03** = 4 and AI A > 12 V or AI A < 1 V
Low voltage of fail safe Supply	**A4**	Alarm ON	If 5 V < fail safe supply <18 V. Enabled by **¡08**
Check supply to ICAD	**A5**	Alarm ON	If supply voltage < 18 V
Calibration extended failed	**A6**	Alarm ON	Check valve type selected. Check presence of foreign body internally in valve
Internal temperature alarm	**A7**	Alarm ON	Temperature for stepper motor component too high. Ventilate/lower ambient ICAD temperature
	A8	Alarm ON	Temperature for stepper motor component too high. Ventilate/lower ambient ICAD temperature.
POM mode (Preventive Operational Mode)	**A9**	See **¡18** and **¡21**	Only active if **¡16** = 1 If ICAD meets too high torque from ICM valve (increased friction/sticking surfaces) ICAD automatic goes in to POM mode to overcome lost step. (See **¡18** and **¡21**)

Parameter list – Valid from: (¡58:14, ¡59:45) and onwards

☝ The first parameter to be entered shall be: **¡26**

Description	ICAD parameter	Min	Max	Factory Setting	Stored	Unit	Password	Comments
OD (Opening degree)	–	0	100			%	–	ICM/ICMTS valve Opening Degree (CVE pressure setting) is displayed during normal operation. Running display value (see **¡01**, **¡05**).
Main Switch	**¡01**	1	2	1	✔	–	No	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.

Mode	**¡02**	1	2	1	✔	–	No	Operation mode 1: Modulating – ICM, ICMTS & CVE positioning according to Analog Input (see **¡03**) 2: ON/OFF – ICM only. Operating the ICM valve like an ON/OFF solenoid valve controlled via Digital Input. See also **¡09**. 3: Neutralzone / 3 point control – ICM only. Increase/ Decrease Opening Degree by Digital Input. See fig. 9
AI signal	**¡03**	1	4	2	✔	–	No	Type of AI signal from external controller 1: 0 – 20 mA 2: 4 – 20 mA 3: 0 – 10 V 4: 2 – 10 V
Speed In Modulating Mode Opening/closing speed In ON/OFF Mode Opening speed In Neutralzone/ 3 point control Opening speed = 10	**¡04**	1	100	50/ 100	✔	–	No	Speed can be decreased. Max. speed is 100 % – Not active in manual operation (**¡01** = 2) For CVE the speed should not exceed 50 (factory setting) If **¡26**= 1 – 3 then factory setting =100 If **¡26**= 4 – 10 then factory setting =50 If the valve is opening and (**¡04** < = 33) or the valve is closing and (**¡14** < = 33) => Low is displayed. If the valve is opening and (33 < If **¡04** < = 66) or the valve is closing and (33 < If **¡14** < = 66) => Med is displayed. If the valve is opening and (**¡04** > = 67) or the valve is closing and (**¡14** > = 67) => High is displayed”
Automatic calibration	**¡05**	0	2	0		–	No	Not active before **¡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”
AO signal	**¡06**	0	2	2	✔	–	No	Type of A0 signal for ICM valve position 0: No signal 1: 0 – 20 mA 2: 4 – 20 mA
Failsafe	**¡07**	1	4	1	✔	–	No	Define condition at power cut and fail safe supply is installed. 1: Close valve 2: Open Valve 3: Maintain valve position 4: Go to OD given by **¡12**“
Fail safe supply	**¡08**	0	1	0	✔		Yes	Fail safe supply connected and enable of A4 alarm: 0 : No 1: Yes
DI function	**¡09**	1	2	1	✔		No	Define function when DI is ON (short circuited DI terminals) when **¡02** = 2 1: Open ICM valve (DI = OFF = > Close ICM valve) 2: Close ICM valve (DI = OFF = > Open ICM valve)
Password	**¡10**	0	199	0		–	–	Enter number to access password protected parameters: **¡26** Password = 11

Old Alarms	**¡11**	A1	A99	–		–	No	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.
OD at power cut.	**¡12**	0	100	50	✔		No	Only active if **¡07** = 4 If fail safe supply is connected and power cut occurs, the valve will go to the specified OD.
Inverse operation	**¡13**	0	1	0	✔		No	When **¡02** = 1 0: Increasing Analog Input signal => Increasing ICM Opening Degree 1: Increasing Analog Input signal => Decreasing ICM Opening Degree When **¡02** = 3 0: DI1 = ON, DI2 = OFF => Increasing valve Opening Degree. DI1 = OFF, DI2 = ON => Decreasing valve Opening Degree DI1 = DI2 = OFF => ICAD/ICM maintain current position DI1 = DI2 = ON => ICAD/ICM maintain current position 1: DI1 = ON, DI2 = OFF => Decreasing ICM Opening Degree DI1 = OFF, DI2 = ON => Increasing ICM Opening Degree DI1 = DI2 = OFF => ICAD/ICM maintain current position DI1 = DI2 = ON => ICAD/ICM maintain current position

Parameter list (continued)

Description	ICAD parameter	Min	Max	Factory Setting	Stored	Unit	Password	Comments
In ON/OFF Mode Closing speed In Neutralzone/ 3 point control Closing speed = 10	**¡14**	0	100	50/100	✔	–	No	See **¡04**. Not applicable to CVE If **¡26**= 1 – 3 then factory setting = 100 If **¡26**= 4 – 10 then factory setting = 50
Manual set point	**¡15**	0	100	0		–	No	When **¡01**= 2, **¡15** determine the start up value
Encoder operation	**¡16**	0	1	1	✔	–	Yes	**NB**: Password protected. Password = 7 0: Encoder disabled. Means ICAD operation as ICAD 600A/ICAD 600A-TS/1200A without encoder. 1: Encoder enabled
Forced closing when ICM valve Opening Degree < 3 %	**¡17**	0	1	0	✔	–	No	Enable/Disable forced closing. Not applicable to CVE 0: When ICM valve Opening Degree < 3% it will be forced to close regardless of requested ICM valve Opening Degree 1: When ICM valve Opening Degree < 3% no forced to closing will take place

Action when ICAD is losing step See Note 1	**¡18**	0	6	6	✔	–	No	Action when ICAD is losing step.0: A boost starts if lost step is detected. After 15 sec, the A9 alarm is flashing and DO A Common Alarm is ON. A second boost starts after the time in **¡19** has elapsed. If the second boost cyklus does not bring the valve back in operation a forced calibration is carried out. 3: A9 alarm flashing after 15 sec. DO A Common Alarm ON. ICAD is locked in actual position. No boost cyklus, Reset by Power OFF/ON, regardless of setting **¡21** 6: Boost cyklus starts if lost step is detected. After 3 boost cyklus the A9 alarm is flashing and DO A Common Alarm is ON. Time interval between boost is set in **¡19**. The boost cyklus continues until the valve is back in operation.
Delay after boost, before A9 alarm See Note 1	**¡19**	0	30	1	✔	Minutes	No	Time delay between two boosts. Linked to **¡18** function
Max offset value See Note 1	**¡20**	3	15	3	✔	%	Yes	Password=13. Offset value (numeric)=Requested Opening Degree [%] from Analog Input – Opening Degree [%] from encoder (Used with **¡21**)
Define how to Reset/ Suppress A9 alarm See Note 1	**¡21**	0	4	1	✔	–	No	Define how to Reset/Suppress A9 alarm. A9 alarm means A9 flashing in display and DO Common Alarm ON 0: Reset by Power OFF/ON 1: Autoreset when ICAD have succeeded to come back into normal operation. Normal operation defined as: Offset value < **¡20** (Max offset value) and **¡22** (delay) has elapsed. 2: A9 alarm is suppressed, meaning no A9 flashing in display and DO Common Alarm remains OFF
Reset delay for A9 See Note 1	**¡22**	1	20	5	✔	Minutes	No	Reset delay for A9. Use when **¡21**= 1 **OBSERVE: ¡22** is recommended always to be bigger than **¡19** (**¡22**>**¡19**)

Valve configuration	**¡26**	0	9	0	✔	–	Yes	**NB**: Password protected. Password = 11 0: No valve selected. Alarm A1 will become active 1: ICM 20 with ICAD 600A / ICMTS 20 with ICAD 600A-TS 2: ICM 25 with ICAD 600A 3: ICM 32 with ICAD 600A / ICMTS 50/80 with ICAD 600A-TS 4: ICM 40 with ICAD 1200A 5: ICM 50 with ICAD 1200A 6: ICM 65 with ICAD 1200A 7: ICM 100 with ICAD 1200A 8: ICM 125 with ICAD 1200A 9: ICM 150 with ICAD 1200A 10: CVE pilot with ICAD 1200A
Running current factor	**¡30**	0	20	10	✔	–	Yes	Password=19. Mandatory to set, if ICM/ICADs are installed/serviced, with cold liquid (-30 °C (-22 °F) or lower) passing through ICM valve. See also document number AN285243155312
Holding current factor	**¡31**	0	20	10	✔	–	Yes	

Note 1:
After a parameter change, it is necessary to carry out a Power OFF/ON

Service

Description	ICAD parameter	Min	Max	Factory Setting	Stored	Unit	Password	Comments
OD %	**¡50**	0	100	–		%	–	ICM valve Opening Degree / CVE pressure setting
AI [mA]	**¡51**	0	100	–		mA	–	AI signal
AI [V]	**¡52**	0	100	–		V	–	AI signal
AO [mA]	**¡53**	0	100	–		mA	–	A0 signal
DI	**¡54**	0	1	–		–	–	DI signals. Depending of **¡02** If **¡02** = 2, one digits are shown. See fig. 8 0 : DI1 = OFF 1 : DI1 = ON If **¡02** = 3, two digits are shown. See fig. 9 00 : DI1 = OFF, DI2 = OFF 10 : DI1 = ON, DI2 = OFF 01 : DI1 = OFF, DI2 = ON 11 : DI1 = ON, DI2 = ON
DO Close	**¡55**	0	1	–		–	–	DO Closed status. ON when OD < 3 %
DO Open	**¡56**	0	1	–		–	–	DO Open status. ON when OD > 97 %
DO Alarm	**¡57**	0	1	–		–	–	DO alarm status. ON when a Alarm is detected
Display mP SW ver.	**¡58**	0	100	–		–	–	Software version for display microprocessor
Motor mP SW ver.	**¡59**	0	100	–		–	–	Software version for motor microprocessor

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.

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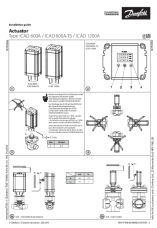
Documents / Resources

	**Danfoss ICAD 600A Motor Actuator with Standard** [pdf] Installation Guide ICAD 600A, ICAD 600A-TS, ICAD 1200A, ICAD 600A Motor Actuator with Standard, ICAD 600A , Motor Actuator with Standard, Actuator with Standard, with Standard

References

- **User Manual**