

CE

APPLICATION NOTES



DELOMATIC 4, DM-4 HYDRO

I/O assignment list



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1. About this document

General purpose

This document contains the application notes for DEIF's Delomatic 4, DM-4, used in hydro applications.



For functional descriptions, the procedure for parameter setup, complete standard parameter lists, etc., please see the Installation Instructions.

The general purpose of the application notes is to offer the designer information about the two methods available for emission control.



Please make sure to read this handbook before working with the DM-4 controller and the gen-set to be controlled. Failure to do this could result in damage to the equipment or human injury.

Intended users

The document is mainly intended for the person responsible for designing DM-4 systems. In most cases, this would be a panel builder designer. Naturally, other users might also find useful information in this document.

Contents/overall structure

The document is divided into chapters, and in order to make the structure of the document simple and easy to use, each chapter will begin from the top of a new page.

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2. Warnings and legal information

Legal information and responsibility

DEIF takes no responsibility for installation or operation of the generator set. If there is any doubt about how to install or operate the generator set controlled by the unit, the company responsible for the installation or the operation of the set must be contacted.

The DM-4 is not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Electrostatic discharge awareness

Sufficient care must be taken to protect the terminals against static discharges during the installation. Once the unit is installed and connected, these precautions are no longer necessary.

Safety issues

Installing the unit implies work with dangerous currents and voltages. Therefore, the installation should only be carried out by authorised personnel who understand the risks involved in working with live electrical equipment.



Be aware of the hazardous live currents and voltages. Do not touch any AC measurement inputs as this could lead to injury or death.

Definitions

Throughout this document, a number of notes and warnings will be presented. To ensure that these are noticed, they will be highlighted in order to separate them from the general text.

Notes



The notes provide general information which will be helpful for the reader to bear in mind.

Warnings



The warnings indicate a potentially dangerous situation which could result in death, personal injury or damaged equipment, if certain guidelines are not followed.

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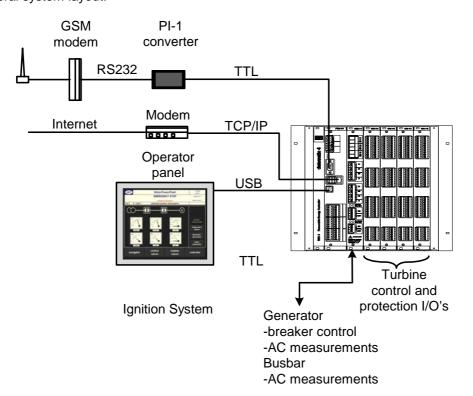
3. General overview

The DM-4 Hydro system consists as a minimum of a double-height (6 HE, 266 mm height) 19" rack mounted with the necessary I/O modules and a 12" colour graphic touchscreen operator interface.

The DM-4 Hydro has a TCP/IP interface with at built-in webserver. This means that the graphic screens are stored here and can be accessed from any computer on the internet, using a free of charge DEIF HMI Client software and thereby enabling remote control and monitoring from anywhere in the world.

Connecting an RS232 GSM modem enables SMS clear text alarm messages.

General system layout:





The Internet/GSM modems are not DEIF supply.

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4. Components

Please refer to the Installation Instructions for components used.

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5. Terminal layouts

Terminal layouts for PCM 4-3 and SCM 4-1 modules, please refer to the Installation Instructions.



The terminal layouts in the following are DEIF standard layouts. Adaptation to a specific project will be normal.

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Terminal layout IOM 4-2, Slot #3, Turbine and valve controls

Temperature inputs

Type	Text	Term.	Term.	Text	Туре
Type	TEXL	Tellii.	Tellii.	TEXL	Type
		1	41		i l
Pt100	Turbine bearing NDE	2	42	Generator bearing	Pt100
PUIOU	Turbine bearing NDE	3	43	NDE	FIIOU
		4	44		
	Turbine bearing DE	5	45		
Pt100		6	46	Thrust bearing	Pt100
FIIOU		7	47		
		8	48		
		9	49		
Pt100	Generator bearing	10	50	Configurable	D+4.00
FIIOU	DE	11	51	Configurable	Pt100
		12	52		

Analogue 4-20 mA inputs

, alaio gao i 20 illi i il pato						
Text	Term.	Term.	Text			
Not used	13	53	Not used			
Turbing abambar program	14	54	Configurable			
Turbine chamber pressure	15	55	Configurable			
Not used	16	56	Not used			
Water level	17	57	Configurable			
Water level	18	58	Configurable			

Analogue 4-20 mA outputs

Text	Term.	Term.	Text
Configurable	19	59	Configurable
Configurable	20	60	
Configurable	21	61	Configurable
Configurable	22	62	Configurable

Digital inputs

Digital inputs						
Text	Term.	Term.	Text			
Fire alarm	23	63	Drain valve open feedback			
Emergency stop	24	64	Drain valve closed feedback			
Watchdog	25	65	Fill valve open feedback			
Safety chain closed	26	66	Fill valve closed feedback			
Main valve open feedback	27	67	Turbine chamber filled			
Main valve closed feedback	28	68	Configurable			
Common for 23-28	29	69	Common for 63-68			

Digital or RPM (pickup) inputs

zigitai ci iti iii (picitap) iiipate					
Text	Term.	Term.	Text		
RPM 1	30	70	Configurable 2		
RPIVIT	31	71	Configurable 2		
Configurable 1	32	72	Configurable 2		
	33	73	Configurable 3		

Transistor (digital) outputs

Text	Term.	Term.	Text
Supply +	34	74	Supply +
Rearm safety chain	35	75	Open main valve command
Open safety chain	36	76	Close main valve command
Close GCB	37	77	Open drain valve command
Trip GCB	38	78	Close drain valve command
Open GCB	39	79	Configurable
Supply -	40	80	Supply -

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Terminal layout IOM 4-2, Slot #4, Turbine, generator and pump controls

Temperature inputs

Type	Text	Term.	Term.	Text	Туре
	1 41				
Pt100	Configurable	2	42	Configurable	D+4.00
PLIOU	Configurable	3	43	Configurable	Pt100
		4	44		
		5	45		
Pt100	Configurable	6	46	Configurable	Pt100
FLIOU	Configurable	7	47		
		8	48		
	Configurable	9	49		
Pt100		10	50	Configurable	D+100
F1100		11	51	Configurable	Pt100
		12	52		

Analogue 4-20 mA inputs

Analogue 4-20 mA inputs						
Text	Term.	Term.	Text			
Not used	13	53	Not used			
Lhudraulia ail progoura	14	54	Luba ail progruma			
Hydraulic oil pressure	15	55	Lube oil pressure			
Not used	16	56	Not used			
Coolont water process	17	57	Configurable			
Coolant water pressure	18	58	Configurable			

Analogue 4-20 mA outputs

Analogue + 20 mA outputs					
Text	Term.	Term.	Text		
Generator voltage/reactive	19	59	Configurable		
power/power factor control	20	60	Configurable		
Configurable	21	61	Configurable		
	22	62	Configurable		

Digital inputs

Text	Term.	Term.	Text
Cooling water pump 1 running	23	63	Hydraulic oil press OK
Cooling water pump 2 running	24	64	Lube oil press OK
Hydraulic oil pump 1 running	25	65	Coolant water pressure OK
Hydraulic oil pump 2 running	26	66	Configurable
Lube oil pump 1 running	27	67	Configurable
Lube oil pump 2 running	28	68	Configurable
Common for 23-28	29	69	Common for 63-68

Digital or RPM (pickup) inputs

Bigital of Ki iii (piokap) iiipato					
Text	Term.	Term.	Text		
DDM 2	30	70	Configurable		
RPM 2	31	71	Configurable		
External breaker trip	32	72	Configurable		
	33	73	Configurable		

Transistor (digital) outputs

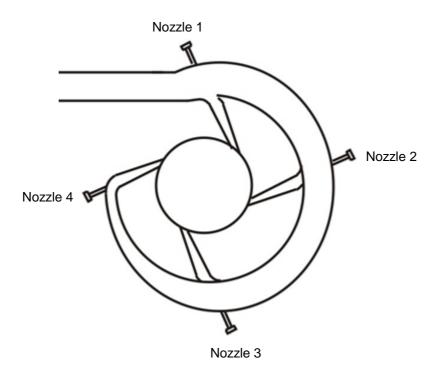
Translator (digital) batbato						
Text	Term.	Term.	Text			
Supply +	34	74	Supply +			
Run cooling water pump 1	35	75	Run Lube oil pump 2			
Run cooling water pump 2	36	76	Open fill valve command			
Run hydraulic oil pump 1	37	77	Close fill valve command			
			Excitation speed (activate			
Run hydraulic oil pump 2	38	78	excitation)			
Run Lube oil pump 1	39	79	Configurable			
Supply -	40	80	Supply -			

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6. Specific hardware for Pelton turbine

The DM-4 Hydro hardware is as standard prepared for Pelton turbines with up to 6 nozzles and up to 6 deflectors.

The nozzles are controlled in cascade, selectable to be either one by one or in counter-positioned pairs, in order to prevent radial stress to the bearings.



Deflector control outputs:

It can be selected if there is:

- No deflector control (engage/disengage by binary output only, for shutdown/trip, deflector 1 engage/disengage commands are used)
- 1 deflector control (for mechanically linked deflectors)
- Up to 6 deflector controls for individually controlled deflectors. Each deflector has position control output as well as engage (trip/shutdown) and disengage (reset) binary outputs.

If deflector control is present, it will be used for fine-tuning of the turbine speed during synchronising, idling and fixed frequency control.

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Terminal layout IOM 4-2, Slot #5, Nozzle/deflector 1 and 2

Temperature inputs

remperature inputs						
Type	Text	Term.	Term.	Text	Type	
		1	41			
Pt100	Configurable	2	42	Configurable	D+100	
Pilou	Configurable	3	43	Configurable	Pt100	
		4	44			
	Pt100 Configurable	5	45	Configurable	Pt100	
D+100		6	46			
Pilou		7	47			
		8	48			
		9	49			
Pt100 Configurable	10	50	Configurable	Pt100		
	11	51				
		12	52			

Analogue 4-20 mA inputs

Allaloguo 4 20 III/ Ilipato						
Text	Term.	Term.	Text			
Not used	13	53	Not used			
Nozzle 1 position feedback	14	54	Deflector 1 position feedback			
	15	55	Deflector 1 position feedback			
Not used	16	56	Not used			
Nozzle 2 position feedback	17	57	Deflector 2 position foodback			
	18	58	Deflector 2 position feedback			

Analogue 4-20 mA outputs

Text	Term.	Term.	Text
Namela dinantian annual	19	59	Deflector 1 position central
Nozzle 1 position control	20	60	Deflector 1 position control
Nozzle 2 position control	21	61	Deflector 2 position control
	22	62	Deflector 2 position control

Digital inputs

Digital inpats						
Text	Term.	Term.	Text			
Nozzle 1 open feedback	23	63	Deflector 1: 100% engaged			
Nozzle 1 closed feedback	24	64	Deflector 1: 0% engaged			
Nozzle 2 open feedback	25	65	Deflector 2: 100% engaged			
Nozzle 2 closed feedback	26	66	Deflector 2: 0% engaged			
Configurable	27	67	Configurable			
Configurable	28	68	Configurable			
Common for 23-28	29	69	Common for 63-68			

Digital or RPM (pickup) inputs

3 ··· · · · · · · · · · · · · · · · · ·					
Text	Term.	Term.	Text		
Configurable 4	30	70	Configurable 6		
Configurable 4	31	71	Configurable 6		
Configurable 5	32	72	Configurable 7		
	33	73	Configurable 7		

Transistor (digital) outputs

Transistor (digital) outputs					
Text	Term.	Term.	Text		
Supply +	34	74	Supply +		
Nozzle 1 open command	35	75	Disengage deflector 1		
Nozzle 1 close command	36	76	Engage deflector 2		
Nozzle 2 open command	37	77	Disengage deflector 2		
Nozzle 2 close command	38	78	Configurable		
Engage deflector 1	39	79	Configurable		
Supply -	40	80	Supply -		

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Terminal layout IOM 4-2, Slot #6, Nozzle/deflector 3 and 4

Temperature inputs

Type	Text	Term.	Term.	Text	Туре
		1	41		
Pt100	Configurable	2	42	Configurable	Pt100
PLIOU	Configurable	3	43	Configurable	PLIOU
		4	44		
	Pt100 Configurable	5	45	Configurable	
D+100		6	46		Pt100
FLIOU		7	47		
		8	48		
		9	49		
Pt100 Configurable	10	50	Configurable	Pt100	
	11	51			
		12	52		

Analogue 4-20 mA inputs

7 tilaio gao 1 20 1117 t in pato						
Text	Term.	Term.	Text			
Not used	13	53	Not used			
Nozzla 2 position foodbook	14	54	Deflector 2 position foodback			
Nozzle 3 position feedback	15	55	Deflector 3 position feedback			
Not used	16	56	Not used			
Nozzla 4 position foodbook	17	57	Deflector 4 position foodbook			
Nozzle 4 position feedback	18	58	Deflector 4 position feedback			

Analogue 4-20 mA outputs

Analogue 4 20 mA outputs						
Text	Term.	Term.	Text			
Namela O a salifar a salasi	19	59	Deflector 2 position central			
Nozzle 3 position control	20	60	Deflector 3 position control			
Nozzle 4 position control	21	61	Deflector 4 position control			
	22	62	Deflector 4 position control			

Digital inputs

Digital iliputs						
Text	Term.	Term.	Text			
Nozzle 3 open feedback	23	63	Deflector 3: 100% engaged			
Nozzle 3 closed feedback	24	64	Deflector 3: 0% engaged			
Nozzle 4 open feedback	25	65	Deflector 4: 100% engaged			
Nozzle 4 closed feedback	26	66	Deflector 4: 0% engaged			
Configurable	27	67	Configurable			
Configurable	28	68	Configurable			
Common for 23-28	29	69	Common for 63-68			

Digital or RPM (pickup) inputs

Digital of Iti III (plottup) Ilipate					
Text	Term.	Term.	Text		
0 6 0	30	70	Configurable 40		
Configurable 8	31	71	Configurable 10		
Configurable 0	32	72	Configurable 11		
Configurable 9	33	73	Configurable 11		

Transistor (digital) outputs

riansistor (digitar) outputs					
Text	Term.	Term.	Text		
Supply +	34	74	Supply +		
Nozzle 3 open command	35	75	Disengage deflector 3		
Nozzle 3 close command	36	76	Engage deflector 4		
Nozzle 4 open command	37	77	Disengage deflector 4		
Nozzle 4 close command	38	78	Configurable		
Engage deflector 3	39	79	Configurable		
Supply -	40	80	Supply -		

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Terminal layout IOM 4-2, Slot #7, Nozzle/deflector 5 and 6

Temperature inputs

Type	Text	Term.	Term.	Text	Туре
		1	41		
Pt100	Configurable	2	42	Configurable	
PLIOU	Configurable	3	43	Configurable	Pt100
		4	44		
	Pt100 Configurable	5	45	Configurable	Pt100
D+100		6	46		
FLIOU		7	47		
		8	48		
		9	49		
Pt100 Configurable	10	50	Configurable	Pt100	
	11	51	Configurable	F1100	
		12	52		

Analogue 4-20 mA inputs

Analogue 4-20 mA inputs					
Text	Term.	Term.	Text		
Not used	13	53	Not used		
Nozzle 5 position feedback	14	54	Deflector Experition feedback		
	15	55	Deflector 5 position feedback		
Not used	16	56	Not used		
Nozzle 6 position feedback	17	57	Deflector C position foodback		
	18	58	Deflector 6 position feedback		

Analogue 4-20 mA outputs

Analogue + 20 mA outputs					
Text	Term.	Term.	Text		
Nozzle 5 position control	19	59	Deflector E position control		
	20	60	Deflector 5 position control		
Nozzle 6 position control	21	61	Deflector 6 position central		
	22	62	Deflector 6 position control		

Digital inputs

Digital iliputs					
Text	Term.	Term.	Text		
Nozzle 5 open feedback	23	63	Deflector 5: 100% engaged		
Nozzle 5 closed feedback	24	64	Deflector 5: 0% engaged		
Nozzle 6 open feedback	25	65	Deflector 6: 100% engaged		
Nozzle 6 closed feedback	26	66	Deflector 6: 0% engaged		
Configurable	27	67	Configurable		
Configurable	28	68	Configurable		
Common for 23-28	29	69	Common for 63-68		

Digital or RPM (pickup) inputs

Digital of it in (pickup) inputs				
Text	Term.	Term.	Text	
Configurable 12	30	70	Configurable 14	
	31	71	Configurable 14	
Configurable 13	32	72	Configurable 15	
	33	73	Configurable 15	

Transistor (digital) outputs

rransistor (digital) outputs					
Text	Term.	Term.	Text		
Supply +	34	74	Supply +		
Nozzle 5 open command	35	75	Disengage deflector 5		
Nozzle 5 close command	36	76	Engage deflector 6		
Nozzle 6 open command	37	77	Disengage deflector 6		
Nozzle 6 close command	38	78	Configurable		
Engage deflector 5	39	79	Configurable		
Supply -	40	80	Supply -		

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7. Specific hardware for Kaplan turbine

The hardware for the Kaplan turbine is prepared for control of guide vane (wicket gate) and runner blade pitch control.

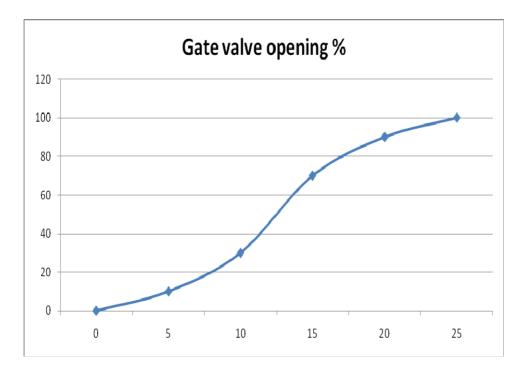
For the adjustment of the guide vanes, a relation to the runner pitch angle is used. Since this relation varies from turbine to turbine, it is configurable using a 6-point curve setting:

No	Runner pitch (degrees)	Guide vane opening (%)
1	0	0
2	5	10
3	10	30
4	15	70
5	20	90
6	25	100



The runner pitch may have a negative value.

The above example provides this curve:



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Terminal layout IOM 4-2, Slot #5, Runner, Guide vane (wicket gate), bypass and brake control

Temperature inputs

Type	Text	Term.	Term.	Text	Туре
		1	41		Pt100
Pt100	Configurable	2	42	Configurable	
PUIOU	Configurable	3	43	Configurable	
		4	44		
	Pt100 Configurable	5	45		
D+100		6	46	Configurable	Pt100
FLIOU		7	47		FLIOU
		8	48		
		9	49		
Dt100 Configurable	Configurable	10	50	Configurable	Pt100
FUIOU	Pt100 Configurable	11	51	Comigurable	FUIOU
		12	52		

Analogue 4-20 mA inputs

i ii iii ii gaa i La iii ii ii pata				
Text	Term.	Term.	Text	
Not used	13	53	Not used	
Out the common of the office of	14	54	Dynasa position foodbook	
Guide vane position feedback	15	55	Bypass position feedback	
Not used	16	56	Not used	
Runner pitch position	17	57	Configurable	
feedback	18	58	Configurable	

Analogue 4-20 mA outputs

7 tilalogae 4 20 lii/t oatpate				
Text	Term.	Term.	Text	
Guide vane position control	19	59	Dynasa position control	
	20	60	Bypass position control	
Runner pitch angle control	21	61	Configurable	
	22	62	Configurable	

Digital inputs

Digital iliputs					
Text	Term.	Term.	Text		
Guide vane 100% feedback	23	63	Brake ON feedback		
Guide vane 0% feedback	24	64	Brake OFF feedback		
Runner pitch max feedback	25	65	Configurable		
Runner pitch min feedback	26	66	Configurable		
Bypass open	27	67	Configurable		
Bypass closed	28	68	Configurable		
Common for 23-28	29	69	Common for 63-68		

Digital or RPM (pickup) inputs

Digital of it. in (plottap) inpute			
Text	Term.	Term.	Text
Configurable	30	70	Configurable
	31	71	
Configurable	32	72	Configurable
	33	73	Configurable

Transistor (digital) outputs

Text	Term.	Term.	Text
Supply +	34	74	Supply +
Guide vane open command	35	75	Bypass open command
Guide vane close command	36	76	Bypass close command
Runner pitch increase			
command	37	77	Brake ON
Runner pitch decrease			
command	38	78	Brake OFF
Configurable	39	79	Configurable

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8. Specific hardware for Francis turbine

The hardware for the Francis turbine is prepared for control of guide vane (wicket gate) pitch control.

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Terminal layout IOM 4-2, Slot #5, Guide vane (wicket gate), bypass and brake control

Temperature inputs

Type	Text	Term.	Term.	Text	Туре
	1	41			
Pt100	Did 00	2	42	Configurable	Pt100
FLIOU	Configurable	3	43	Configurable	
		4	44		
		5	45	Configurable	D±100
Pt100 Configurable	Configurable	6	46		
	7	47	Configurable	Pt100	
		8	48		
Pt100 Configurable	9	49	Configurable	Pt100	
	10	50			
F1100	Configurable	11	51	Configurable	FLIOU
	12	52			

Analogue 4-20 mA inputs

, alaiogus : 20 iii, t iiipato				
Text	Term.	Term.	Text	
Not used	13	53	Not used	
Guide vane position feedback	14	54	Bypass position feedback	
	15	55		
Not used	16	56	Not used	
Configurable	17	57	Configurable	
	18	58	Configurable	

Analogue 4-20 mA outputs

Text	Term.	Term.	Text
Guide vane position control	19	59	Bypass position control
	20	60	
Configurable	21	61	Configurable
	22	62	Configurable

Digital inputs

Digital ilipats				
Text	Term.	Term.	Text	
Guide vane open feedback	23	63	Brake ON feedback	
Guide vane closed feedback	24	64	Brake OFF feedback	
Configurable	25	65	Configurable	
Configurable	26	66	Configurable	
Bypass open	27	67	Configurable	
Bypass closed	28	68	Configurable	
Common for 23-28	29	69	Common for 63-68	

Digital or RPM (pickup) inputs

zigitai ei iti iii (piettap) iiipate			
Text	Term.	Term.	Text
Configurable	30	70	Configurable
	31	71	
Configurable	32	72	Configurable
	33	73	Configurable

Transistor (digital) outputs

ransister (arguar) carpare				
Text	Term.	Term.	Text	
Supply +	34	74	Supply +	
Guide vane open command	35	75	Bypass open command	
Guide vane close command	36	76	Bypass close command	
Configurable	37	77	Brake ON	
Configurable	38	78	Brake OFF	
Configurable	39	79	Configurable	

DEIF A/S reserves the right to change any of the above.

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