DAC-360

Installation manual

Version 1

PREFACE

In this installation manual you find information how to connect and program a DAC-360 shear control for operation with an industrial shear.

LIMITED WARRANTY

- The equipment is supplied by Delem without safety features. The machine manufacturer has to ensure a safe environment.
- This equipment must be installed and used in accordance with Delem's specifications. The guarantee on the equipment is invalidated in the event of improper installation and/ or use of this equipment.
- The General Terms and Conditions of Delivery of Delem shall apply to this product. These conditions are available from Delem on request.
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Table of contents

Parameter index 5

Part I - Hardware description

1. Introduction 1.2

2. Specifications 1.3

2.1. Physical dimensions 1.3
2.2. Environmental conditions 1.3
2.3. Technical specifications 1.4

3. System I/O 1.5

3.1. Introduction 1.5
3.2. Power supply / Analog output 1.6
3.3. Analog I/O 1.6
3.4. Digital I/O 1.7
3.5. Encoder 1.8

4. Spare parts 1.9

5. Schematics 1.10

Part II - Machine settings

1. Machine parameter types 2.2

1.1. Menu 2.2
1.2. Control types 2.2
1.3. Spindle correction table 2.6

2. The machine parameters 2.8

2.1. General parameters 2.8
2.2. Backgauge control parameters 2.10
2.3. Angle control parameters 2.25
2.4. Gap control parameters 2.28
2.5. Stroke control parameters 2.32
2.6. Force control parameters 2.35

3. I/O assignments 2.40

3.1. Inroduction 2.40
3.2. List of I/O signals 2.42

4. Software settings 2.45

4.1. Parameter back-up 2.45
4.2. Upgrade control 2.47
4.3. Special access codes 2.48
4.4. Display codes 2.49

Part III - Diagnostic program

1. Introduction 3.2

1.1. Remarks 3.2
1.2. Test-menu 3.2

1.3. Test functions 3.3
1.4. Service screens 3.3

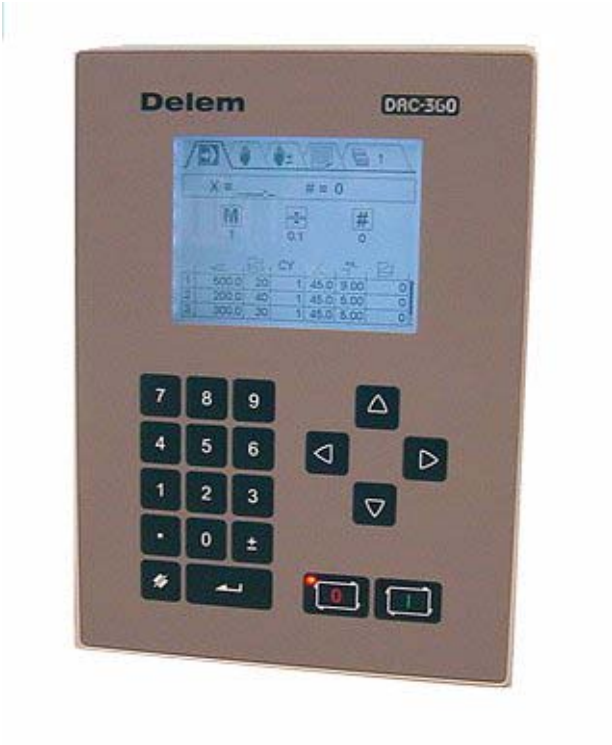
Parameter index

This index contains a list of all machine parameters described in this manual, in alphabetic order.

AC brake enable 2.21
Acceleration ramp 2.24
Acceleration, 0 to max. 2.19
Angle material table 2.27
Angle prestop negative 2.27
Angle prestop positive 2.26
Angle reference table 2.27
Angle tolerance 2.26
Angle/Gap force 2.37
Auto mode enabled 2.8
Auto retract enable 2.16
Blade-up hold time 2.36
Brake delay 2.21
Brake point high speed < 2.22
Brake point high speed > 2.22
Brake point low speed < 2.22
Brake point low speed > 2.22
Braking ramp 2.24
Clamping force 2.37
Clamping force delay 2.38
Clamping force delay 2.39
Clamping force enable 2.38
Clamping force ramp 2.38
Clamping reference table 2.39
Clamping time 2.38
Control enable 2.25
Control enable 2.28
Control enable 2.31
Control type 2.10
Count direction 2.13
Cutting force delay 2.36
Cutting force factor 2.35
DC high speed < 2.23
DC high speed > 2.24
DC low speed < 2.23
DC low speed > 2.23
Deceleration, max. to 0 . . . . . .2.19
Decimal point position 2.11
Default FD functions 2.9
Default retract 2.16
Enable CY 2.9
Enable display correction 2.12
Enable sheet position 2.32
Fixed angle 2.25
Gap material table 2.30
Gap reference table 2.29
Gap2 reference table 2.31
I-gain 2.20
In Position tolerance 2.25
Limit speed 2.19
Main force enable 2.35
Main force ramp 2.36
Main force reference table 2.35
Manual speed high 2.11
Maximum cutting length 2.8
Maximum operating speed 2.18
Maximum stroke 2.33
Maximum thickness 2.8
Maximum value 2.10
Minimum retract 2.16
Minimum stroke 2.32
Minimum value 2.10
Number of FD functions 2.9
Opening delay 2.37
Opening force 2.37
Overrun 2.17
Overrun wait time 2.18
P-gain 2.20
Positioning tolerance 2.21
Pre scaling 2.12
Prestop 2.34
Prestop negative 2.29
Prestop negative 2.31
Prestop positive 2.28
Prestop positive 2.31
Reference position 2.14
Reference search 2.13
Reference search direction 2.14
Reference search speed 2.14
Retract hold 2.16
Retract programmable 2.15
Rotation offset 2.34
RSD switch mounted 2.15
Safety Zone 2.17
Spindle allowance 2.17
Spindle correction table 2.13
Stop decelaration 2.20
Stop time 2.23
Stroke mode 2.32
Stroke reference table 2.33
Stroke time 2.33
Unipolar 2.25
X/Gap correction enable 2.11
X-correction enable 2.12
X-limit 2.18
X-speed programmable 2.10

Part I - Hardware description

This section contains the hardware specifications of a Delem DAC-360 control.



1. Introduction

The DAC-360 is a universal programmable control, designed to control positioning of machine parts such as the backgauge control of an industrial shear.
The control is capable of controlling servo-loop systems, a one- or two-speed AC or DC drive system.

2. Specifications

2.1. Physical dimensions

For the dimensions of the control, see the included drawings at the end of this section.

2.2. Environmental conditions

The following environment specification values are valid for a DAC-360 control:

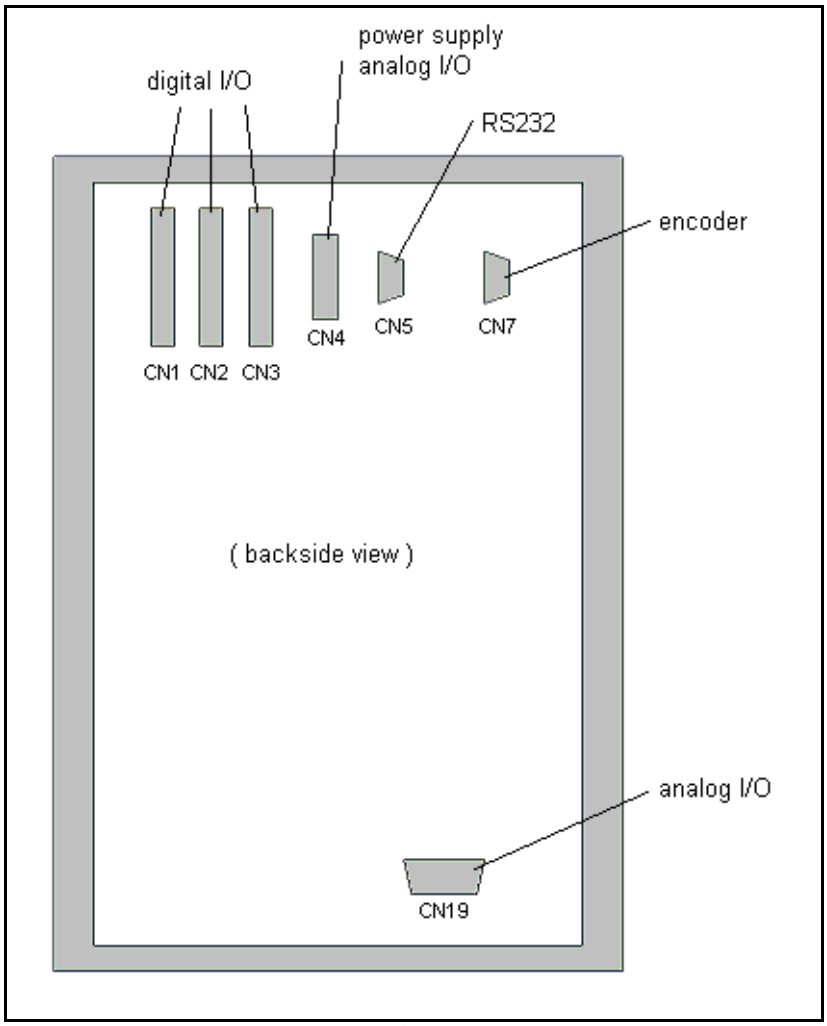
Ambient temperature	5 - 50°C
Storage temperature	min. -20°C max. 70°C
Relative humidity	max. 90 % non-condensing
EMC	designed and built to meet the following standards: EN50081-2 EN50082-2
Protection rate	IP54 when built-in, assuming the enclosure is also IP54

2.3. Technical specifications

Power supply	18 - 28 VDC 5W (I/O excluded)
Display	LCD/STN resolution 320 x 240 black/white
Interfaces	1 x Encoder, max. 1 MHz 1 x RS-232
I/O	8 x Digital input, 24V 16 x Digital output, 24V 1 x analog output 0 +/- 10V 2 x analog output 0 - 10V 3 x analog input 0 - 10V (each incl. 10V ref.)

3. System I/O

3.1. Introduction



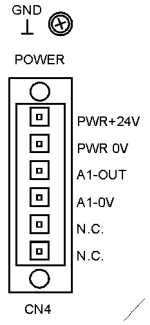
1.a

The backside of the control is equipped with a set of connectors for various functions:
- system I/O
- encoder feedback
- communication

The various connectors are discussed in the following sections.

Warning:
Connectors may not be plugged or unplugged when power is ON. Connectors may only be connected or disconnected when power is OFF.

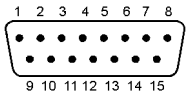
3.2. Power supply / Analog output



Connector CN4 contains the connection for the power supply and the analog output for axis movement.

Power supply	18 - 28 VDC 5W (I/O excluded)
Analog output	0 +/- 10V 10mA max.

3.3. Analog I/O

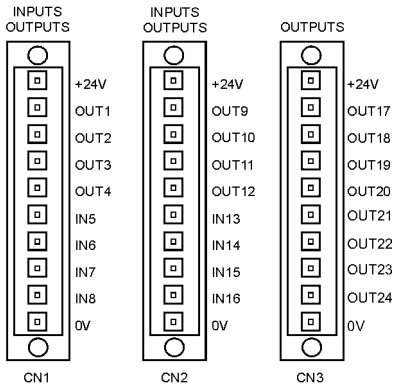


The Analog connector CN19 provides several analog signals, two analog outputs and three analog inputs.

See schematic 8062-101 for connection details.
Specifications for Analog I/O:

analog inputs (3x)	0-10V, input impedance 44 kΩ
reference voltage (3x)	10V ± 2%, minimal resistance 1 kΩ
analog outputs (2x)	0 - 10V 10mA max. minimal resistance 1 kΩ

3.4. Digital I/O



8 inputs, 16 outputs.
See schematic 8062-101 for connection details.
The use of I/O pins depends on the application and machine settings. For the purpose of all assigned I/O signals please consult part 2 of this manual.

I/O power supply: 24 V DC + 20%
8A max.

CN1 & CN2: Pins 1 - 16

Programmable Digital In-/Outputs:

Digital Outputs (8x)	Voltage	Current
ON state	20-28 V DC	0.5 A max.
OFF state	0-4 V DC	0.1 mA max. (leakage current)

Digital Input (8x)	Voltage	Current
ON state	9-28 V DC	20 mA max.
OFF state	0-4 V DC	1 mA max.

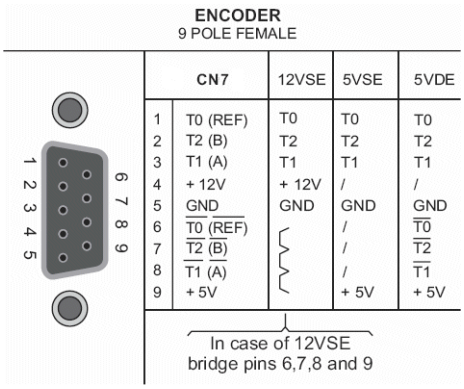
CN3: Pins 17 - 24

Programmable Digital Outputs (8x):

Digital Outputs (4x)	Voltage	Current
ON state	20-28 V DC	0.5 A max.
OFF state	0-4 V DC	0.1 mA max. (leakage current)

Notes:
- The sum of all output currents should not exceed 8A.
- All digital outputs are short-circuit proof.

3.5. Encoder



	CN7	12VSE	5VSE	5VDE
1	T0 (REF)	T0	T0	T0
2	T2 (B)	T2	T2	T2
3	T1 (A)	T1	T1	T1
4	+ 12V	+ 12V	/	/
5	GND	GND	GND	GND
6	$\overline{T0}$ ($\overline{REF}$)		/	$\overline{T0}$
7	$\overline{T2}$ ($\overline{B}$)		/	$\overline{T2}$
8	$\overline{T1}$ ($\overline{A}$)		/	$\overline{T1}$
9	+ 5V		+ 5V	+ 5V

9-pole SUBD female encoder interface

power supply:
5V DC/250 mA or 12V DC/200 mA

possibilities:
12 V single ended
5 V single ended
5 V differential
Max. count frequency 1 MHz

See schematic 8062-101 for connection details.

Notes:
- In case of 12VSE encoder, connect pins 6, 7, 8 and 9 with eachother.

4. Spare parts

The following table gives an overview of the available spare parts for the DAC-360 control.

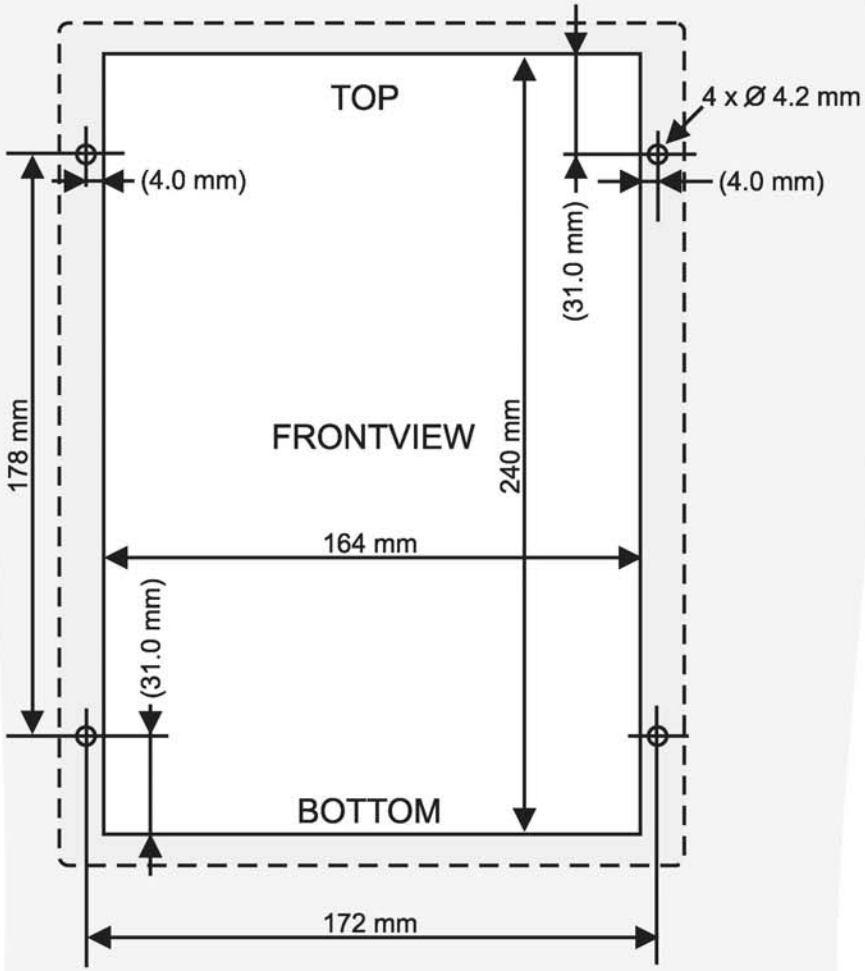
Number	Description
FRONT-360	Front panel DAC-360
DLCD-360	LCD screen
D-7453-001	Mainboard DAC-360

5. Schematics

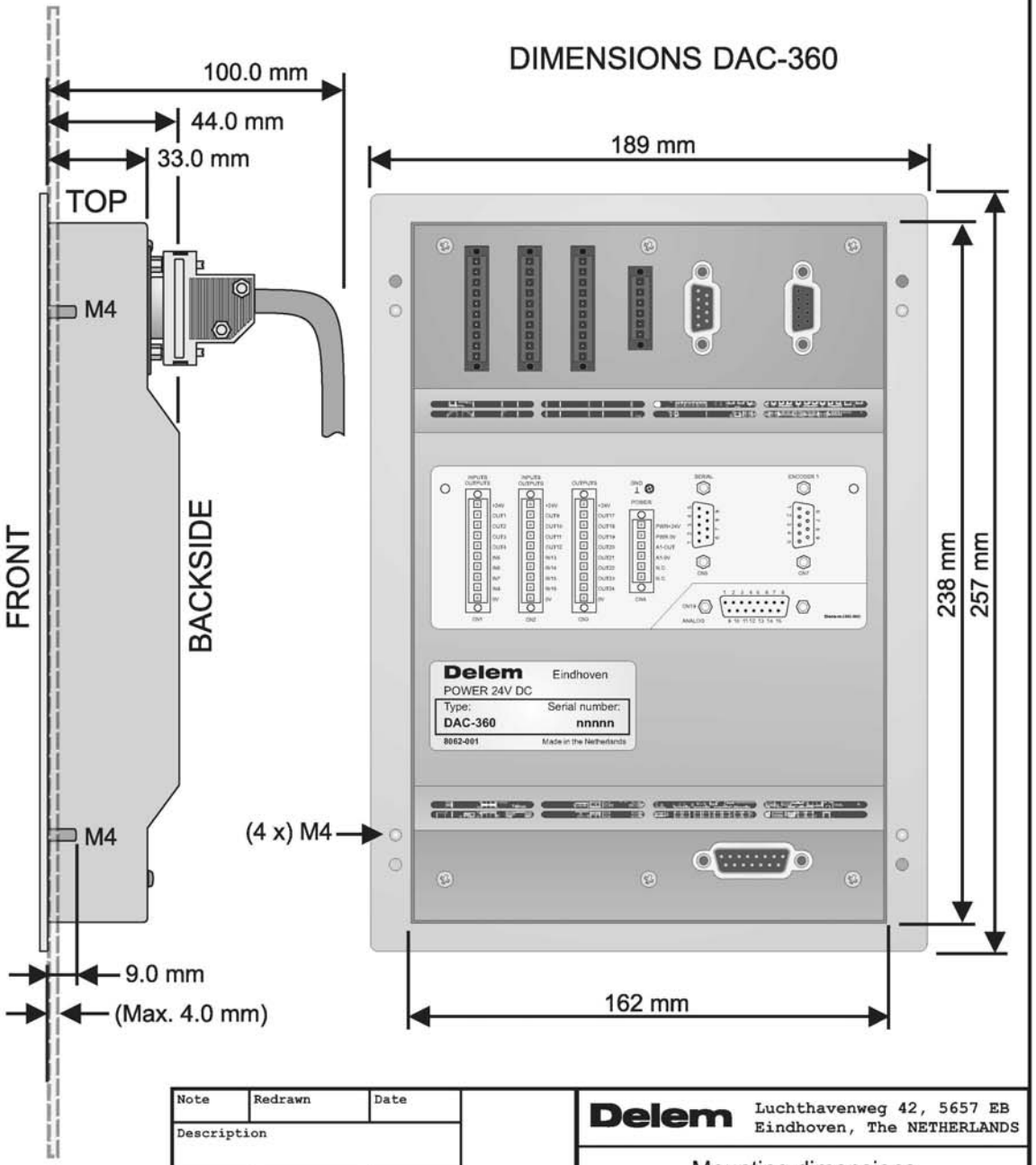
The following pages show several schematics about the DAC-360 control:

8062-901	Mounting dimensions
8062-912	Cables and connectors
8062-101	Connection diagram
8062-103	Connection diagram
8062-104	Connection diagram
8062-107	Connection diagram
8062-108	Connection diagram
8062-907	Default I/O Allocation

CUT OUT DIMENSIONS



DIMENSIONS DAC-360



Note	Redrawn	Date
Description		
Note	Redrawn	Date
Description		
Measures in mm, unless otherwise specified	Drawn HNF	Date 15-12-2006

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Mounting dimensions
DAC-360

Format		Number	Issue
A3		8062-901	-

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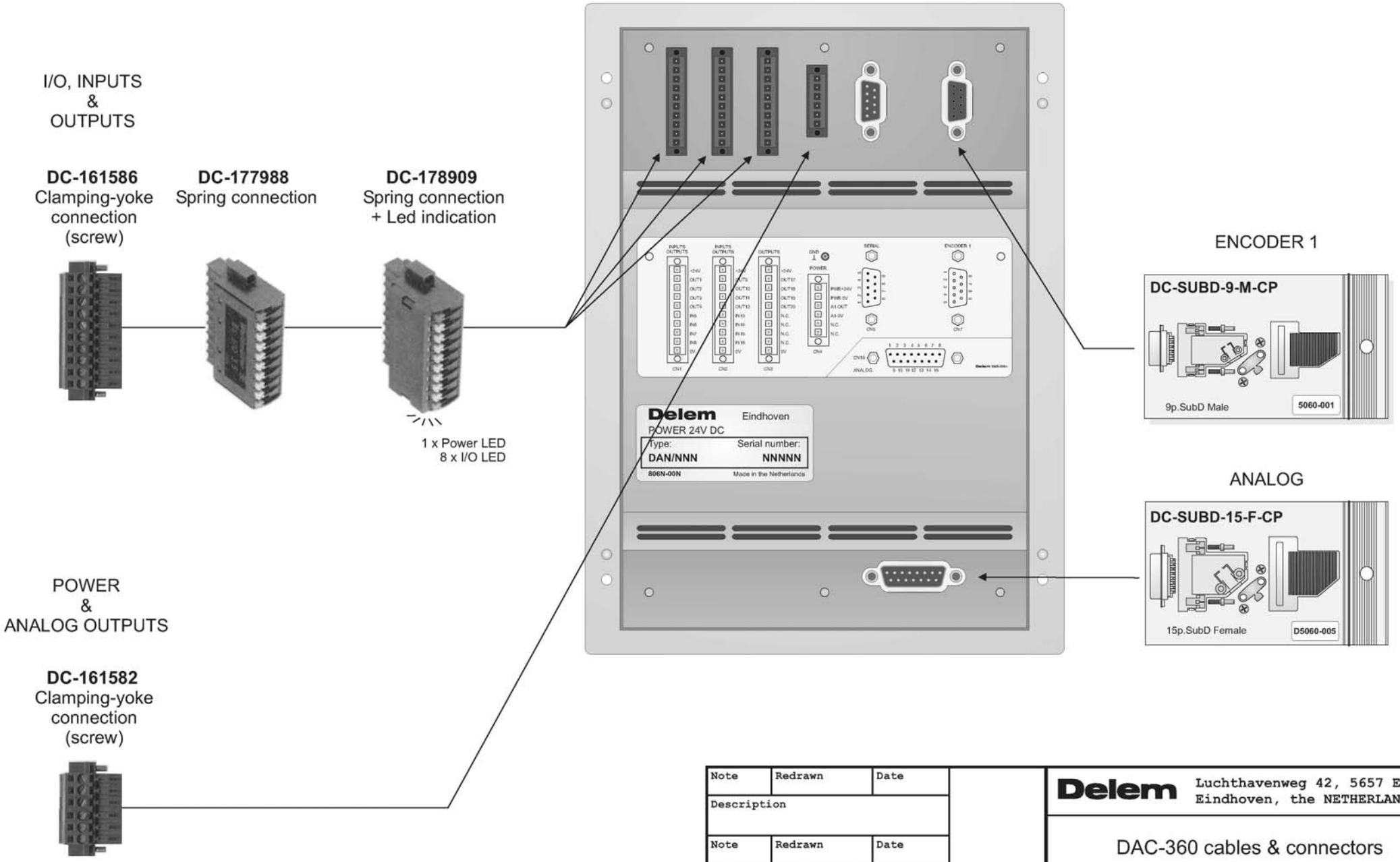

Note	Redrawn	Date
Description		
Note	Redrawn	Date
Description		
Measures in mm,unless otherwise specified	Drawn HNF	Date 21-03-2007

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DAC-360 cables & connectors

Format	Number	Issue
A3	8062-912	-

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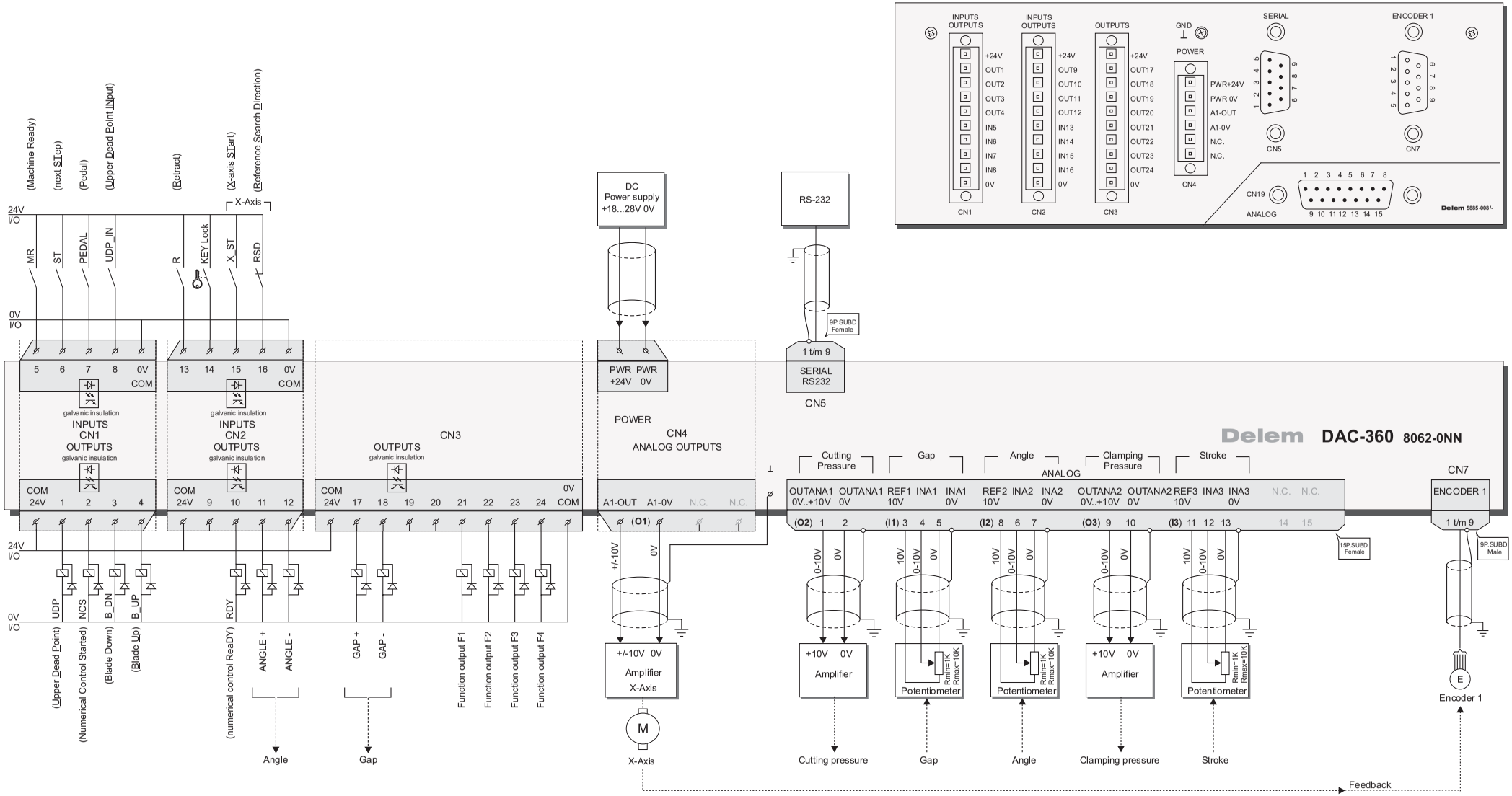

INPUTS / OUTPUTS
10 POLE MALE

CN1	CN2	CN3
+24V	+24V	+24V
OUT-1	OUT-9	OUT-17
OUT-2	OUT-10	OUT-18
OUT-3	OUT-11	OUT-19
OUT-4	OUT-12	OUT-20
IN-5	IN-13	OUT-21
IN-6	IN-14	OUT-22
IN-7	IN-15	OUT-23
IN-8	IN-16	OUT-24
0V	0V	0V

INPUTS / OUTPUTS
6 POLE MALE

CN4
POWER IN +24...28VDC
POWER IN 0V
A1-OUT -10V...+10V
A1-0V
Not connected
Not connected

SERIAL
9 POLE MALE

CN5	
1	Not connected
2	Received Data
3	Transmitted Data
4	Not connected
5	Signal Ground
6	Not connected
7	Request to Send
8	Clear to Send
9	Not connected

ENCODER
9 POLE FEMALE

	CN6,7	12VSE	5VSE	5VDE
1	T0 (REF)	T0	T0	T0
2	T2 (B)	T2	T2	T2
3	T1 (A)	T1	T1	T1
4	+ 12V	+ 12V	/	/
5	GND	GND	GND	GND
6	$\overline{T0}$ ($\overline{REF}$)		/	$\overline{T0}$
7	$\overline{T2}$ ($\overline{B}$)		/	$\overline{T2}$
8	$\overline{T1}$ ($\overline{A}$)		/	$\overline{T1}$
9	+ 5V		+ 5V	+ 5V

In case of 12VSE bridge pins 6,7,8 and 9

ANALOG
15 POLE MALE

CN15	
1	OUTANA1 0V...+10V
2	OUTANA1 0V
3	REF1 10V
4	INA1
5	INA1 0V
6	INA2
7	INA2 0V
8	REF2 10V
9	OUTANA2 0V...+10V
10	OUTANA2 0V
11	REF3 10V
12	INA3
13	INA3 0V
14	N.C.
15	N.C.

Note 1 : Leave unconnected pins open.
Note 2 : 24V relais supply must be separated from 24V supply

See drawing 8062-907 for default digital I/O allocation.
See drawing 8062-901 for mounting dimensions.

Note	Redrawn	Date
Description		
Note A	Redrawn HNF	Date 17-04-2007
Description Maintenance#2533 Signals connector CN1 & CN2 changed.		
Measures in mm,unless otherwise specified	Drawn HNF	Date 24-01-2007

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Example connections:
Servo X-Axis,Gap control
Angle control ,Stroke(IN3)

Format	Page 1 /1	Number	Issue
A3		8062-101	A

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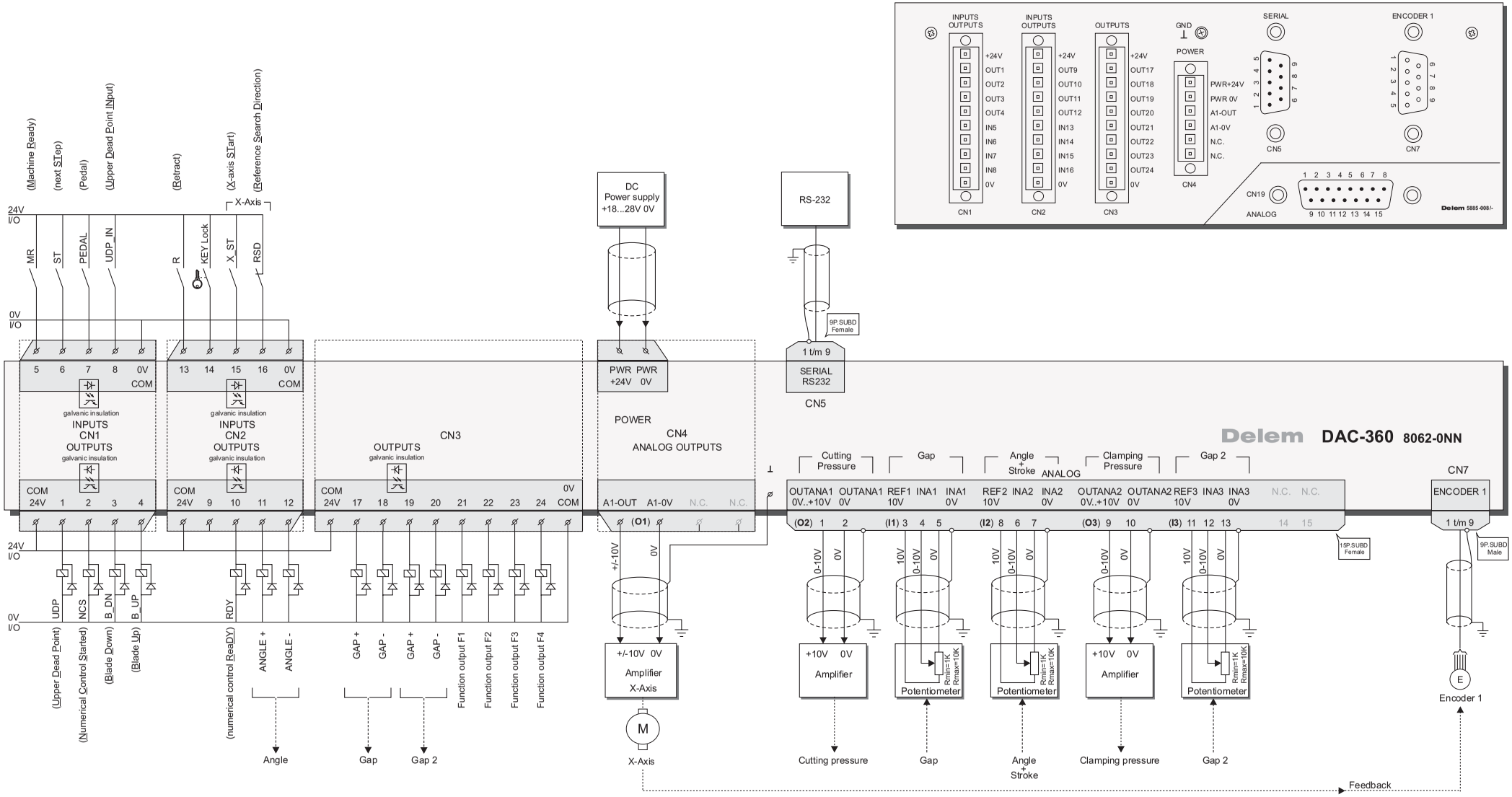

INPUTS / OUTPUTS
10 POLE MALE

CN1	CN2	CN3
+24V	+24V	+24V
OUT-1	OUT-9	OUT-17
OUT-2	OUT-10	OUT-18
OUT-3	OUT-11	OUT-19
OUT-4	OUT-12	OUT-20
IN-5	IN-13	OUT-21
IN-6	IN-14	OUT-22
IN-7	IN-15	OUT-23
IN-8	IN-16	OUT-24
0V	0V	0V

INPUTS / OUTPUTS
6 POLE MALE

CN4
POWER IN +24...28VDC
POWER IN 0V
A1-OUT -10V...+10V
A1-0V
Not connected
Not connected

SERIAL
9 POLE MALE

	CN5
1	Not connected
2	Received Data
3	Transmitted Data
4	Not connected
5	Signal Ground
6	Not connected
7	Request to Send
8	Clear to Send
9	Not connected

ENCODER
9 POLE FEMALE

	CN6,7	12VSE	5VSE	5VDE
1	T0 (REF)	T0	T0	T0
2	T2 (B)	T2	T2	T2
3	T1 (A)	T1	T1	T1
4	+ 12V	+ 12V	/	/
5	GND	GND	GND	GND
6	$\overline{T0}$ ($\overline{REF}$)		/	$\overline{T0}$
7	$\overline{T2}$ ($\overline{B}$)		/	$\overline{T2}$
8	$\overline{T1}$ ($\overline{A}$)		/	$\overline{T1}$
9	+ 5V		+ 5V	+ 5V

In case of 12VSE bridge pins 6,7,8 and 9

ANALOG
15 POLE MALE

CN15	
1	OUTANA1 0V...+10V
2	OUTANA1 0V
3	REF1 10V
4	INA1
5	INA1 0V
6	INA2
7	INA2 0V
8	REF2 10V
9	OUTANA2 0V...+10V
10	OUTANA2 0V
11	REF3 10V
12	INA3
13	INA3 0V
14	N.C.
15	N.C.

Note 1 : Leave unconnected pins open.
Note 2 : 24V relais supply must be separated from 24V supply

See drawing 8062-907 for default digital I/O allocation.
See drawing 8062-901 for mounting dimensions.

Note	Redrawn	Date
Description		
Note A	Redrawn HNF	Date 17-04-2007
Description Maintenance#2533 Signals connector CN1 & CN2 changed.		
Measures in mm, unless otherwise specified	Drawn HNF	Date 24-01-2007

Delem Luchthavenweg 42, 5657 EB Eindhoven, the NETHERLANDS

Example connections:
Servo X-Axis,Gap control
Gap 2 control Angle control ,Angle/Stroke(IN2)

Format	Page 1 /1	Number	Issue
A3		8062-103	A

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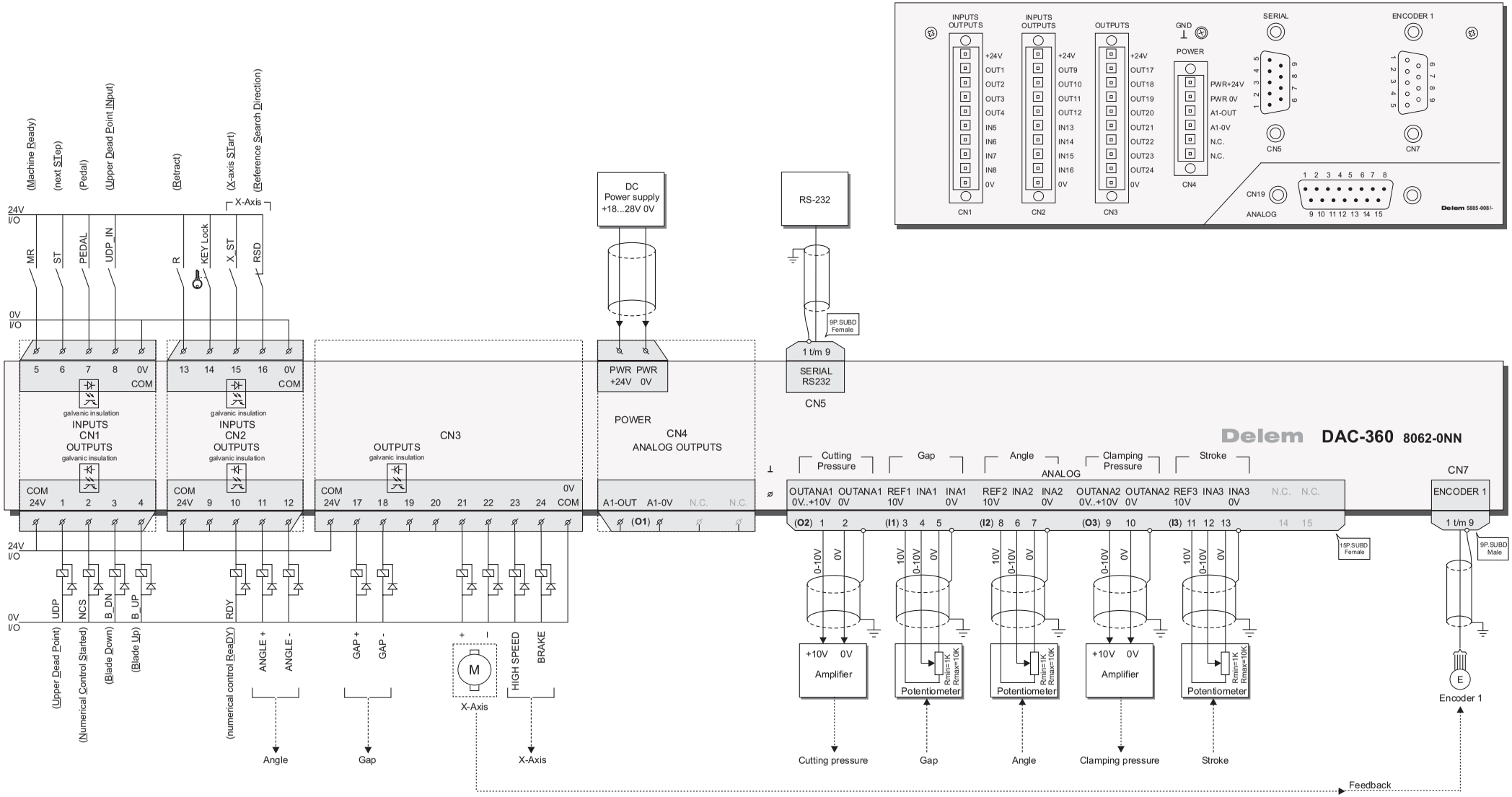

INPUTS / OUTPUTS
10 POLE MALE

CN1	CN2	CN3
+24V	+24V	+24V
OUT-1	OUT-9	OUT-17
OUT-2	OUT-10	OUT-18
OUT-3	OUT-11	OUT-19
OUT-4	OUT-12	OUT-20
IN-5	IN-13	OUT-21
IN-6	IN-14	OUT-22
IN-7	IN-15	OUT-23
IN-8	IN-16	OUT-24
0V	0V	0V

INPUTS / OUTPUTS
6 POLE MALE

CN4
POWER IN +24...28VDC
POWER IN 0V
A1-OUT -10V...+10V
A1-0V
Not connected
Not connected

SERIAL
9 POLE MALE

CN5	
1	Not connected
2	Received Data
3	Transmitted Data
4	Not connected
5	Signal Ground
6	Not connected
7	Request to Send
8	Clear to Send
9	Not connected

ENCODER
9 POLE FEMALE

	CN6,7	12VSE	5VSE	5VDE
1	T0 (REF)	T0	T0	T0
2	T2 (B)	T2	T2	T2
3	T1 (A)	T1	T1	T1
4	+ 12V	+ 12V	/	/
5	GND	GND	GND	GND
6	$\overline{T0}$ (REF)		/	$\overline{T0}$
7	$\overline{T2}$ (B)		/	$\overline{T2}$
8	$\overline{T1}$ (A)		/	$\overline{T1}$
9	+ 5V		+ 5V	+ 5V

In case of 12VSE bridge pins 6,7,8 and 9

ANALOG
15 POLE MALE

CN15	
1	OUTANA1 0V...+10V
2	OUTANA1 0V
3	REF1 10V
4	INA1
5	INA1 0V
6	INA2
7	INA2 0V
8	REF2 10V
9	OUTANA2 0V...+10V
10	OUTANA2 0V
11	REF3 10V
12	INA3
13	INA3 0V
14	N.C.
15	N.C.

Note 1 : Leave unconnected pins open.
Note 2 : 24V relais supply must be separated from 24V supply

See drawing 8062-907 for default digital I/O allocation.
See drawing 8062-901 for mounting dimensions.

Note	Redrawn	Date
Description		
Note A	Redrawn HNF	Date 17-04-2007
Description Maintenance#2533 Signals connector CN1 & CN2 changed.		
Measures in mm, unless otherwise specified	Drawn HNF	Date 24-01-2007

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Example connections:
AC X-Axis Single- / Dual-speed + brake, Gap
Angle control ,Stroke(IN3)

Format	Page 1 /1	Number	Issue
A3		8062-104	A

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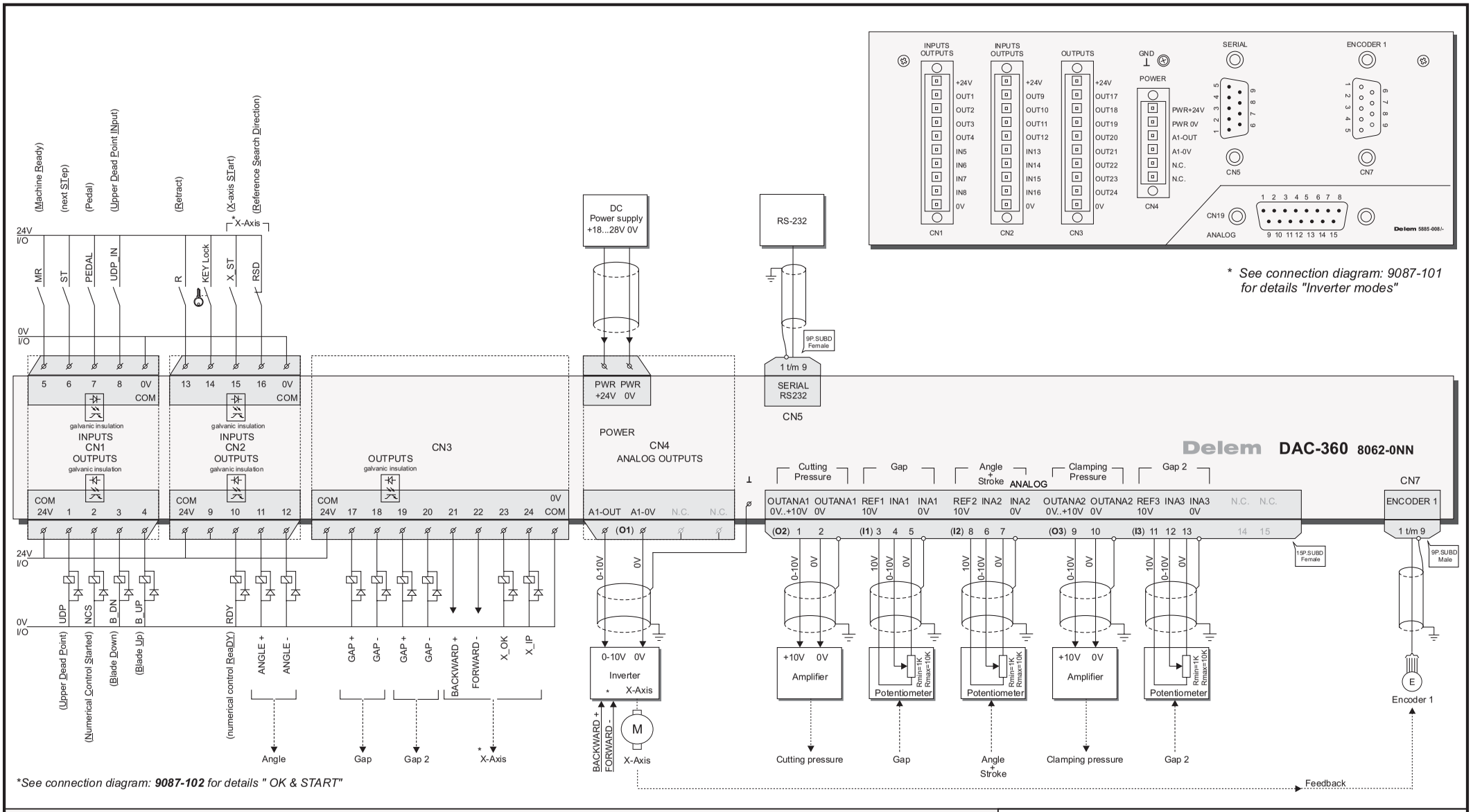

INPUTS / OUTPUTS
10 POLE MALE

CN1	CN2	CN3
+24V	+24V	+24V
OUT-1	OUT-9	OUT-17
OUT-2	OUT-10	OUT-18
OUT-3	OUT-11	OUT-19
OUT-4	OUT-12	OUT-20
IN-5	IN-13	OUT-21
IN-6	IN-14	OUT-22
IN-7	IN-15	OUT-23
IN-8	IN-16	OUT-24
0V	0V	0V

INPUTS / OUTPUTS
6 POLE MALE

CN4
POWER IN +24...28VDC
POWER IN 0V
A1-OUT -10V...+10V
A1-0V
Not connected
Not connected

SERIAL
9 POLE MALE

CN5	
1	Not connected
2	Received Data
3	Transmitted Data
4	Not connected
5	Signal Ground
6	Not connected
7	Request to Send
8	Clear to Send
9	Not connected

ENCODER
9 POLE FEMALE

	CN6,7	12VSE	5VSE	5VDE
1	T0 (REF)	T0	T0	T0
2	T2 (B)	T2	T2	T2
3	T1 (A)	T1	T1	T1
4	+ 12V	+ 12V	/	/
5	GND	GND	GND	GND
6	$\overline{T0}$ (REF)		/	$\overline{T0}$
7	$\overline{T2}$ (B)		/	$\overline{T2}$
8	$\overline{T1}$ (A)		/	$\overline{T1}$
9	+ 5V		+ 5V	+ 5V

In case of 12VSE bridge pins 6,7,8 and 9

ANALOG
15 POLE MALE

CN15	
1	OUTANA1 0V...+10V
2	OUTANA1 0V
3	REF1 10V
4	INA1
5	INA1 0V
6	INA2
7	INA2 0V
8	REF2 10V
9	OUTANA2 0V...+10V
10	OUTANA2 0V
11	REF3 10V
12	INA3
13	INA3 0V
14	N.C.
15	N.C.

Note 1 : Leave unconnected pins open.
Note 2 : 24V relais supply must be separated from 24V supply

See drawing 8062-907 for default digital I/O allocation.
See drawing 8062-901 for mounting dimensions.

Note	Redrawn	Date
Description		
Note A	Redrawn HNF	Date 17-04-2007
Description Maintenance#2533 Signals connector CN1 & CN2 changed.		
Measures in mm,unless otherwise specified	Drawn HNF	Date 24-01-2007

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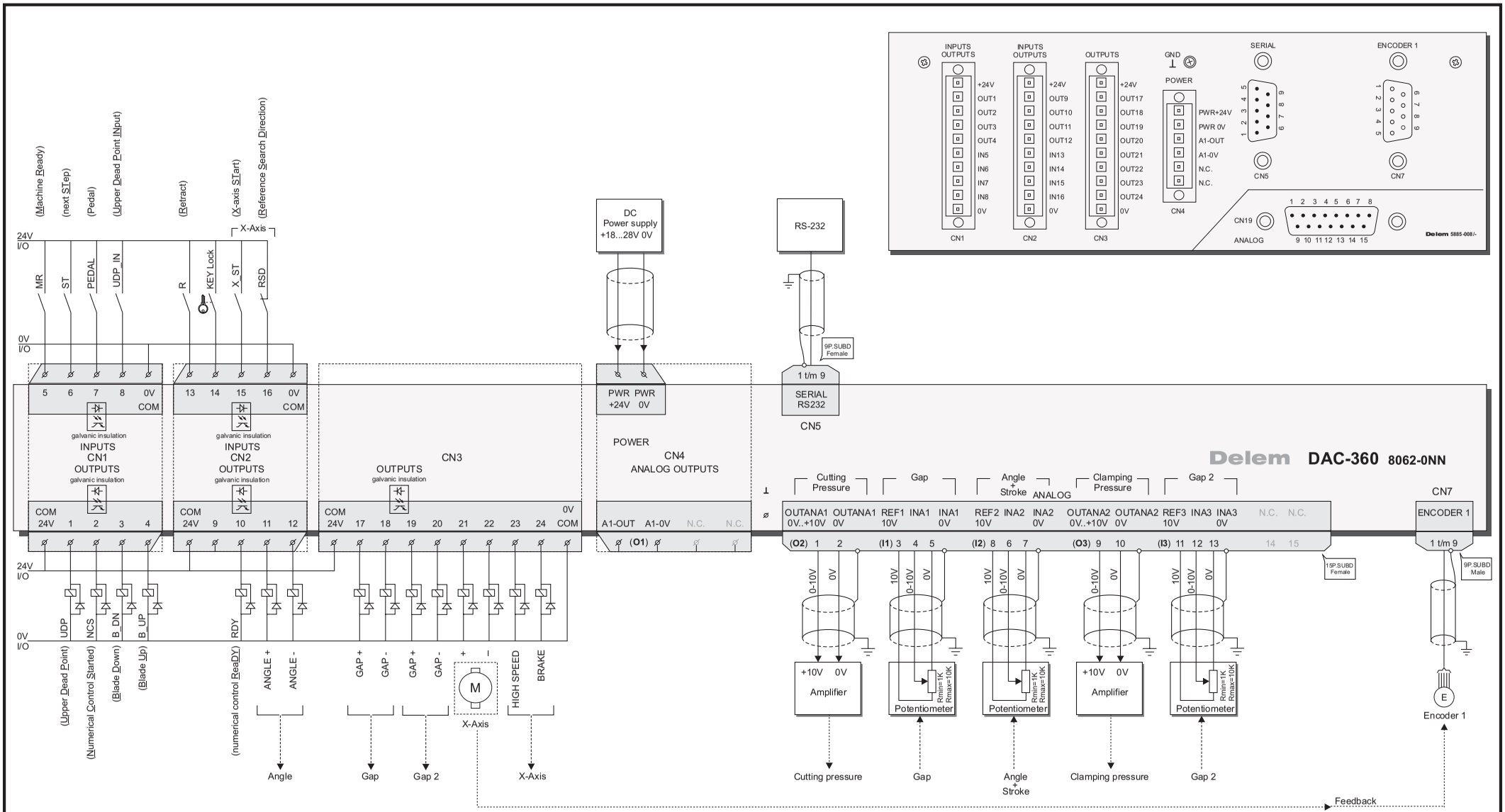
Example connections:
AC X-Axis Unipolar inverter, Gap control
Gap 2 control Angle control ,Angle/Stroke(IN2)

Format	Page	Number	Issue
A3	1 /1	8062-107	A

No unauthorized copying allowed Scale



INPUTS / OUTPUTS
10 POLE MALE

CN1	CN2	CN3
+24V	+24V	+24V
OUT-1	OUT-9	OUT-17
OUT-2	OUT-10	OUT-18
OUT-3	OUT-11	OUT-19
OUT-4	OUT-12	OUT-20
IN-5	IN-13	OUT-21
IN-6	IN-14	OUT-22
IN-7	IN-15	OUT-23
IN-8	IN-16	OUT-24
0V	0V	0V

INPUTS / OUTPUTS
6 POLE MALE

CN4
POWER IN +24...28VDC
POWER IN 0V
A1-OUT -10V...+10V
A1-0V
Not connected
Not connected

SERIAL
9 POLE MALE

CN5	
1	Not connected
2	Received Data
3	Transmitted Data
4	Not connected
5	Signal Ground
6	Not connected
7	Request to Send
8	Clear to Send
9	Not connected

ENCODER
9 POLE FEMALE

	CN6,7	12VSE	5VSE	5VDE
1	T0 (REF)	T0	T0	T0
2	T2 (B)	T2	T2	T2
3	T1 (A)	T1	T1	T1
4	+ 12V	+ 12V	/	/
5	GND	GND	GND	GND
6	$\overline{T0}$ (REF)		/	$\overline{T0}$
7	$\overline{T2}$ (B)		/	$\overline{T2}$
8	$\overline{T1}$ (A)		/	$\overline{T1}$
9	+ 5V		+ 5V	+ 5V

In case of 12VSE bridge pins 6,7,8 and 9

ANALOG
15 POLE MALE

CN15	
1	OUTANA1 0V...+10V
2	OUTANA1 0V
3	REF1 10V
4	INA1
5	INA1 0V
6	INA2
7	INA2 0V
8	REF2 10V
9	OUTANA2 0V...+10V
10	OUTANA2 0V
11	REF3 10V
12	INA3
13	INA3 0V
14	N.C.
15	N.C.

Note 1 : Leave unconnected pins open.
Note 2 : 24V relais supply must be separated from 24V supply

See drawing 8062-907 for default digital I/O allocation.
See drawing 8062-901 for mounting dimensions.

Note	Redrawn	Date
Description		
Note A	Redrawn HNF	Date 17-04-2007
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Measures in mm,unless otherwise specified	Drawn HNF	Date 24-01-2007

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Example connections:
AC X-Axis Single- / Dual-speed + brake, Gap
Gap 2 control Angle control ,Angle/Stroke(IN2)

Format	Page 1 /1	Number	Issue
A3		8062-108	A

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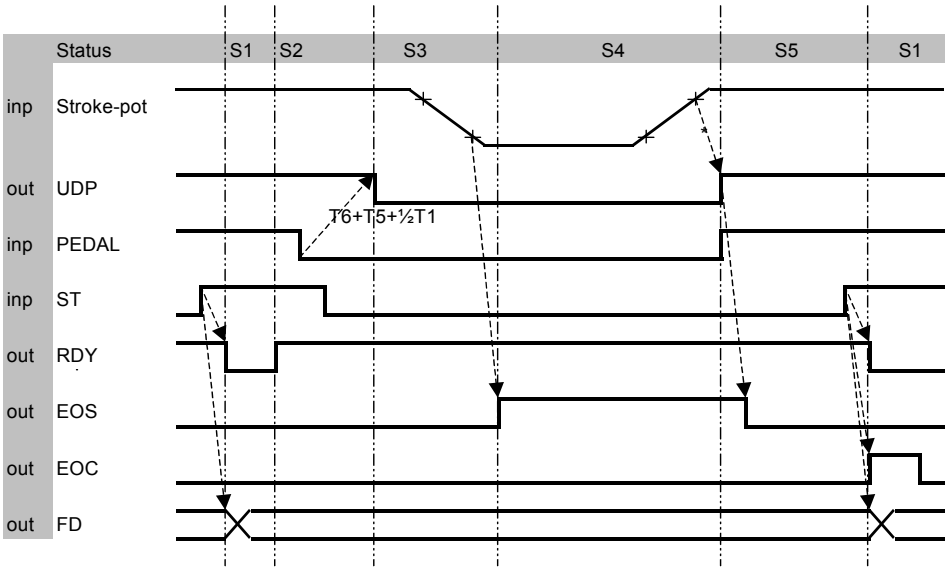
Timing diagrams

DAC-360 with stroke potentiometer

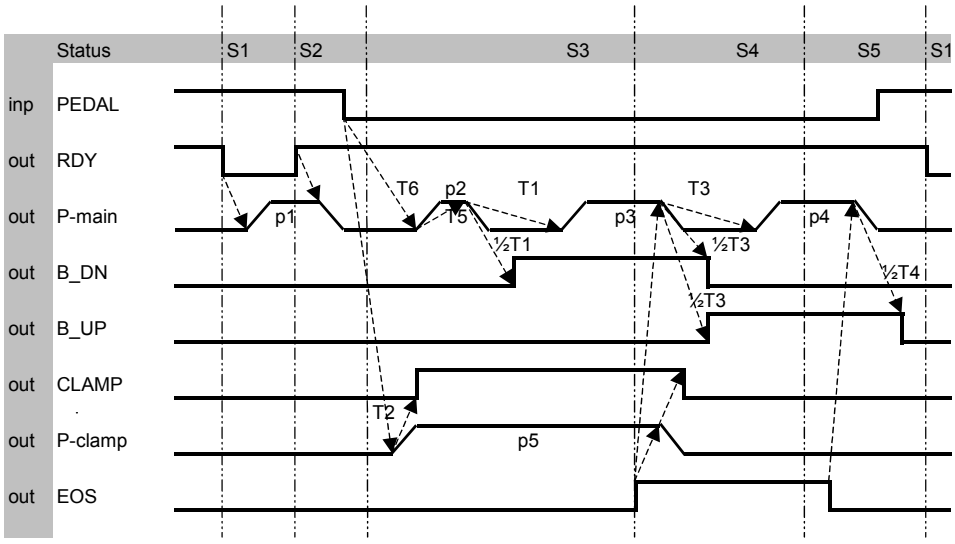


S0 = Controller Stopped
S1 = Positioning
S2 = Wait for ST low
S3 = Wait for EOS
S4 = Wait for UDP
S5 = Wait for ST high

T1 = Delay before cutting force
T5 = Clamping time
T6 = Delay before main clamping force

* = UDP high only if UDPIN high in case of:
gauge position inside safety zone or
Angle needs adjustment
in case of combined potentiometer

DAC-360 pressure outputs

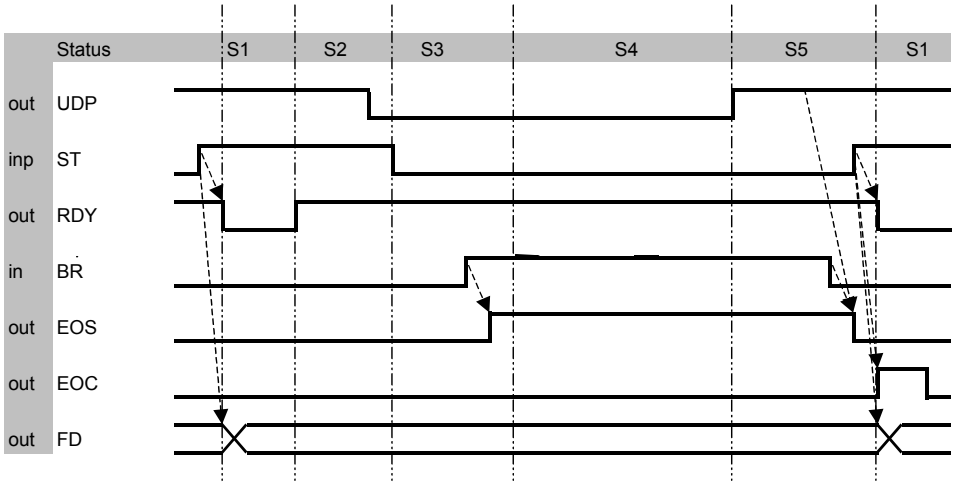


S0 = Controller Stopped
S1 = Positioning
S2 = Wait for ST low
S3 = Wait for EOS
S4 = Wait for UDP
S5 = Wait for ST high

T1 = Delay before cutting force
T2 = Delay before clamping force
T3 = Delay before opening
T4 = Delay before Angle/Gap force
T5 = Clamping time
T6 = Delay before main clamping force

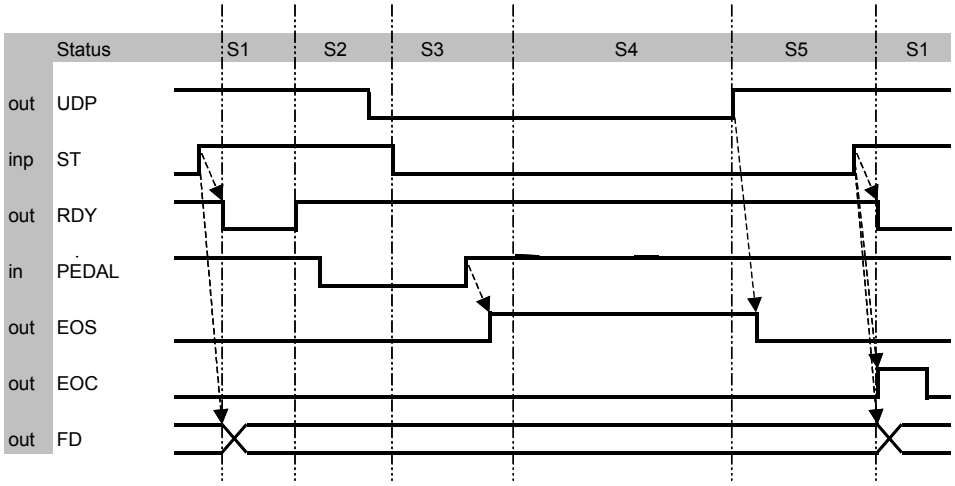
p1 = Angle/Gap force
p2 = Main clamping force
p3 = Cutting force
p4 = Opening force
p5 = Clamping force

DAC-360 Interrupted cycle with Blade Return (BR)



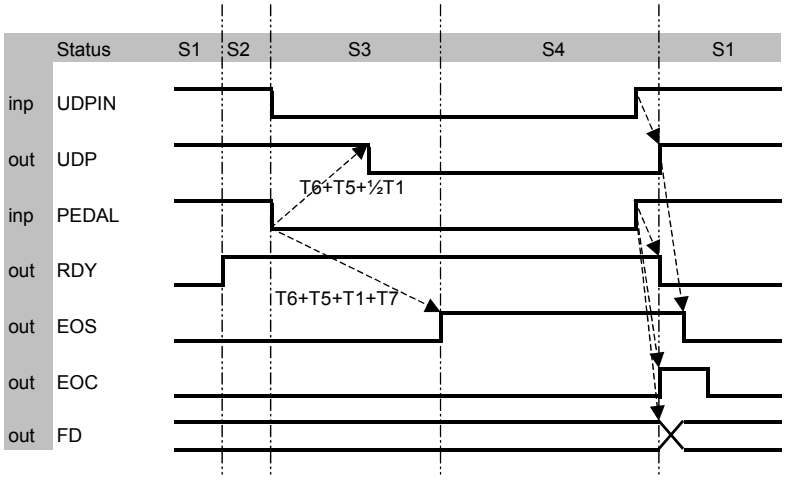
S0 = Controller Stopped
S1 = Positioning
S2 = Wait for ST low
S3 = Wait for EOS
S4 = Wait for UDP
S5 = Wait for ST high

DAC-360 Interrupted cycle with PEDAL



S0 = Controller Stopped
S1 = Positioning
S2 = Wait for ST low
S3 = Wait for EOS
S4 = Wait for UDP
S5 = Wait for ST high

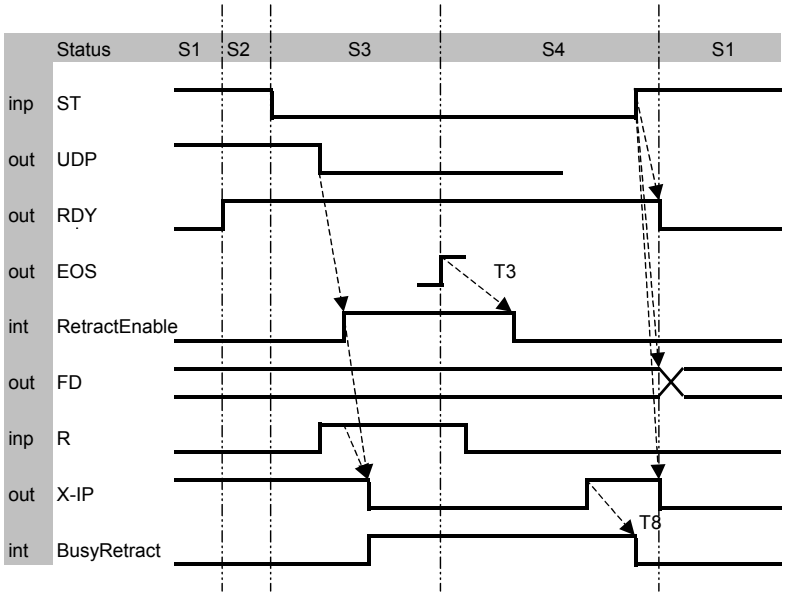
DAC-360 with timed stroke



S0 = Controller Stopped
S1 = Positioning
S2 = Wait for ST low
S3 = Wait for EOS
S4 = Wait for ST high

T1 = Delay before cutting force
T5 = Clamping time
T6 = Delay before main clamping force
T7 = Stroke time

DAC-360 Retract Timing

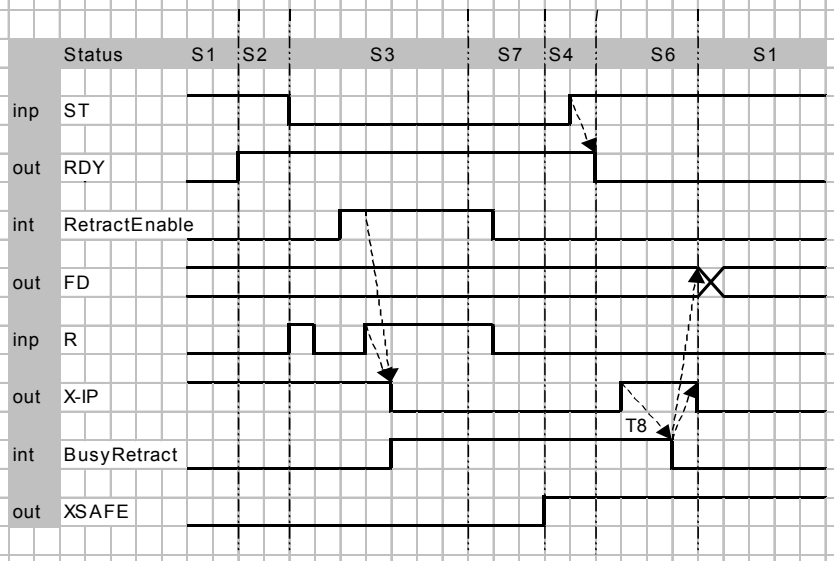


S0 = Controller Stopped
S1 = Positioning
S2 = Wait for STEP low
S3 = Wait for EOS
S4 = Wait for STEP high

T3 = Delay before opening

T8 = Retract hold

DAC-360 Retract Timing (Wait for Retract)



S0 = Controller Stopped
S1 = Positioning
S2 = Wait for ST low
S3 = Wait for EOS
S4 = Wait for ST high
S6 = Wait for End-of-Retract
S7 = Wait for X outside SZ

T8 = Retract hold

Part II - Machine settings

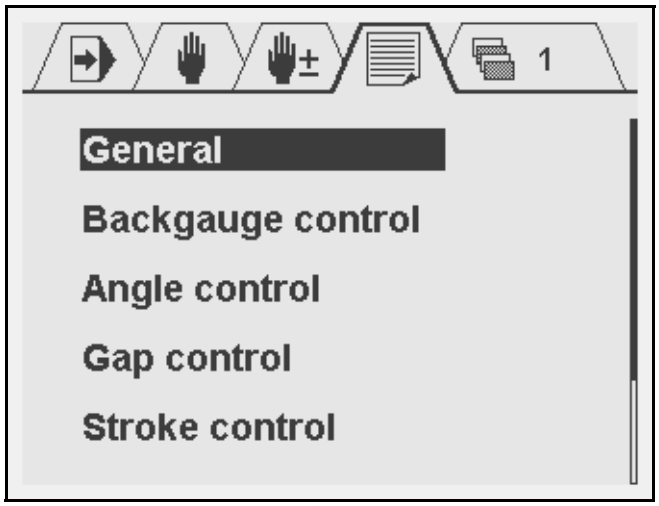
This section will describe the necessary settings of a DAC-360 control regarding machine settings.

1. Machine parameter types

1.1. Menu

The machine parameters are only accessible with a special entry code. Machine parameters should be adjusted by authorized personnel only. To enter the machine parameters menu:

- go to the screen with program constants;
- scroll to the parameter ‘language’;
- enter the code 852;
- press ENTER.



2.a

From this menu, the several types of machine parameters can be edited. To enter a menu with parameters, move the cursor bar to the correct menu and press ENTER. Press the Stop button to exit a menu or to return to normal operation mode.
In the next chapter the machine parameters are explained. The following sections in this chapter describe the different control systems that are supported.

1.2. Control types

The control can be programmed to control different axis types:

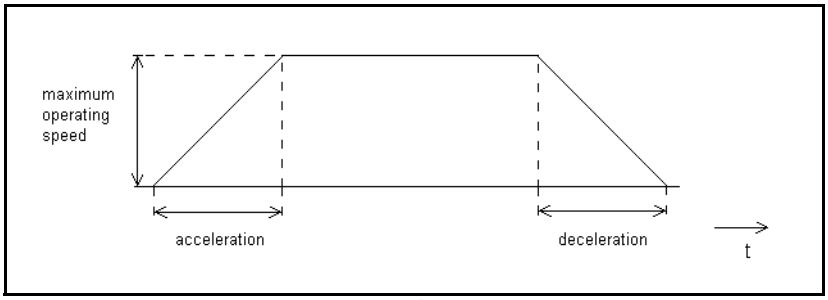
- 1-speed AC or DC drive
- 2-speed AC or DC drive
- Servo motor drive

The required system can be programmed with the parameter 'Control type'.

1.2.1. Servo drive

The following servo parameters are available:

- Maximum operating speed
- Acceleration
- Deceleration
- Emergency deceleration
- P-gain
- I-gain



2.b

The following adjustment procedure can be followed to set the parameters to correct values. Changes in the settings should be checked by moving the axis from one position to another. This stroke should be large enough, so that the axis will reach its maximum speed.

- Set the standard machine parameters, like minimum value, maximum value, scale factor etc., to the correct values.
- Set the maximum operating speed to the correct value. This is the speed of the axis, in mm/s, when the output of the module to the motor amplifier is 10V. If required the speed can be set to a lower value.
- Set the acceleration and deceleration ramp parameters to safe values, for example 500ms or more. Of course these values depend on the actual combination of motor, motordrive and load.
- Set the gain parameters to safe default values, for example:
  - P-gain = 2.50
  - I-gain = 1
- Increase the P-gain until you notice oscillation during the movement and especially at the end position. Reduce the P-gain again to the point where there was no oscillation.
- Increase the I-gain until you notice oscillation at the end position. Reduce the I-gain again to the point where there was no oscillation.
- Optimise the acceleration and deceleration times. Reduce these times until you find an optimal compromise between a fast and smooth movement. If one of these values is set too small, it will lead to irregular behaviour of the axis during acceleration or deceleration.

1.2.2. AC drive

In this paragraph, the parameters for axes with AC drives are discussed.
When using AC drives, it is possible to program 1-side positioning or 2-side positioning.
Beside this, it must be indicated whether a one-speed or 2-speed motor drive is used.
With these parameters you can optimize the positioning accuracy of the AC-axis:

- Brake point high speed (BHS)
- Brake point low speed (BLS)
- Overrun (OR)
- Overrun wait time
- Stop time (T)
- DC low speed
- DC high speed
- AC-brake enable

For the movement control of the axis there are two possibilities:

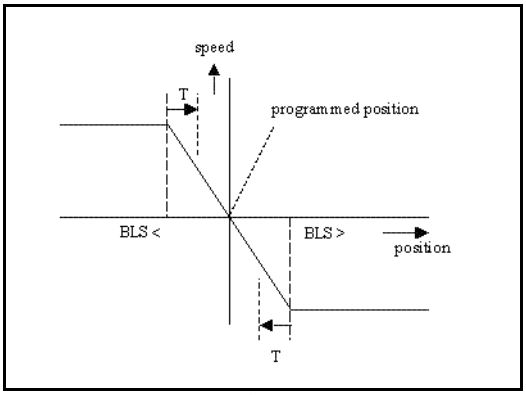
- two, three or four digital outputs of the module;

- one analog output signal.

The type of control can be specified as on-off control. When there is a position error, the control signal is on. When there is no position error, the control signal is off.

- 1-speed AC axis

For a 1-speed axis, the parameter 'axis type' must be set to 1. This axis can be driven through 2 digital outputs or through the analog output.

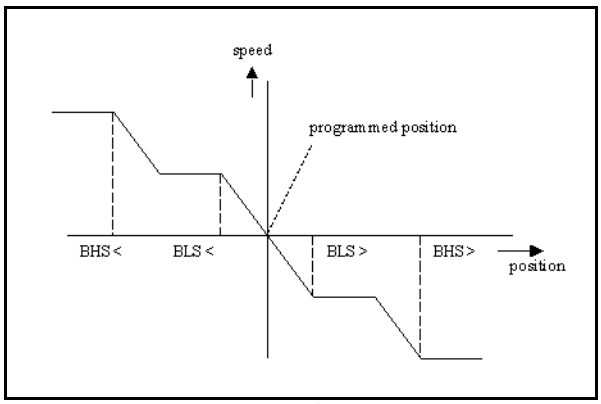


2.c

For this axis, the parameter 'Brake point low speed' (BLS) must be programmed. This parameter defines the switch-off points for the axis movement. The value depends on the known deceleration rate of the axis equipment. If the BLS is not accurate enough to reach the programmed position, the parameter 'Stop time' (T) can be used for further fine-tuning of the positioning.
If the axis is controlled through the analog output, the parameter 'DC slow speed' must be programmed to a correct value.

- 2-speed AC axis

For a 2-speed axis, the parameter 'axis type' must be set to 2. This axis can be driven through 3 or 4 digital outputs or through the analog output. The axis can be controlled at two different speed levels.



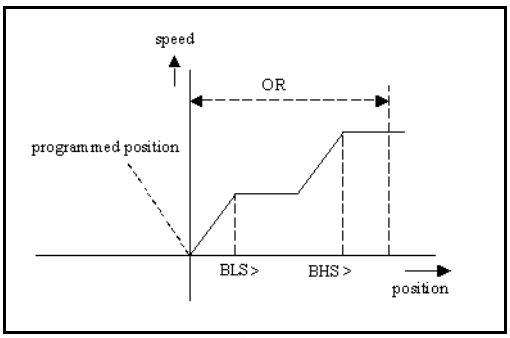
2.d

For this axis, the parameters 'Brake point low speed' (BLS) and 'Brake point high speed' (BHS) must be programmed. These parameters define the switch-off points for high and low

speed for the axis movement. As with the 1-speed axis, the parameter 'Stop time' (T) can be used to improve positioning.
If the analog output is used for axis control, the parameters 'DC high speed' and 'DC low speed' must be programmed at two different values. These values determine the voltage levels at the analog output for the two different speed settings.

- One side positioning:

In the explanations above, the control systems used two-side positioning. So when moving from high to low or vice versa, positioning takes place instantly.
In some cases, it is desired to have positioning only in one direction.



2.e

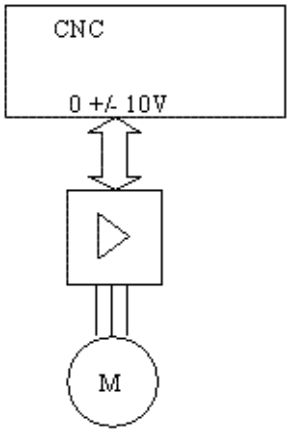
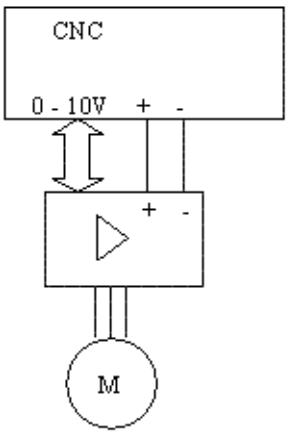
One side positioning is useful to overcome mechanical inaccuracies in the spindle. Final positioning of the axis is always done from a higher to a lower position. So when the axis moves from a high to a low position, positioning is done immediatly. When the axis moves from a low to a high position, the axis will move to the overrun position (= programmed position +OR). After that, the axis starts moving in the opposite direction and positioning takes place.
When the difference between the new programmed position and the actual position is smaller then BLS the axis is always moved to the overrun position first, also in case of two side positioning.
Choosing 1-side or 2-side positioning is done with the parameter 'Spindle allowance'.

- AC brake

The control can be programmed to support a brake on the AC motor. This can be activated with the parameter ‘AC-brake enable’. The motor brake is activated as soon as the speed control is zero.
The brake signal is designed according to fail-safe principle: the signal is TRUE if the axis must move, the signal is FALSE if no movement is allowed (the brake is active).

1.2.3. Unipolar system

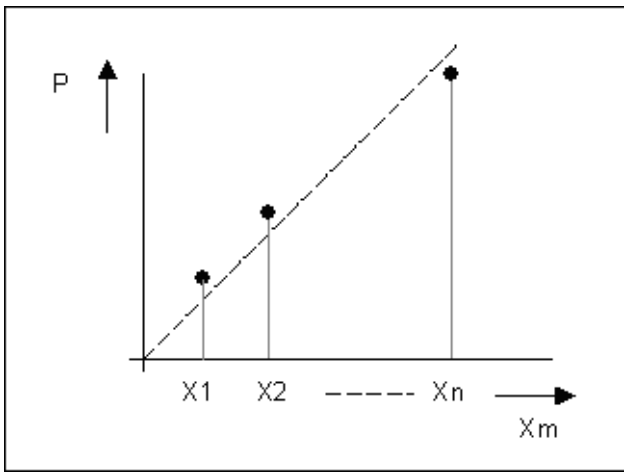
Normally, the analog output can be used for movement control: positive voltage for one direction, negative voltage for the other direction.
In a unipolar system the output voltage is always positive, the movement direction is indicated by digital outputs.

Bipolar:	Unipolar:
	

A unipolar system can be implemented for servo and AC drives.

1.3. Spindle correction table

The spindle correction table is meant to overcome axis position errors due to mechanical inaccuracies in the spindle.
If a spindle shows deviations then they should be measured systematically on certain setpoints. From these setpoints, a table with corrections can be created.



Corrections are calculated as follows:

Cor = Xm - P

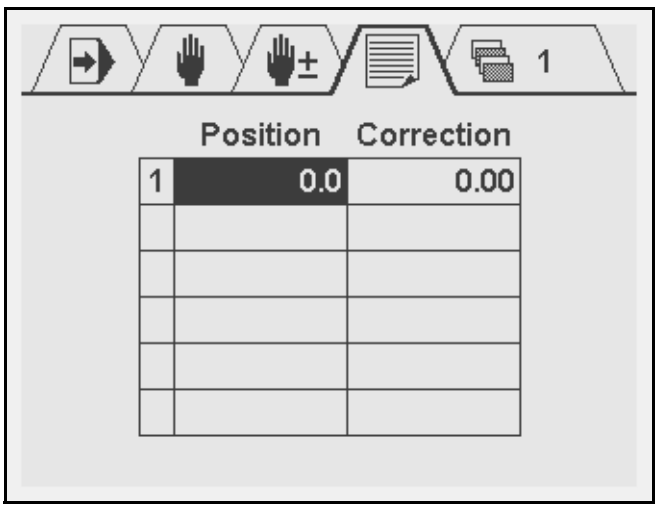
Xm = programmed position
P = measured position
Cor = the necessary correction

Xm	P	Cor
X1	P1	Cor1
X2	P2	Cor2
...	...	...
Xn	Pn	Cor n

All measured axis positions and their corresponding corrections can be entered in a table on the control.
To access the correction table, proceed as follows:

- enter the machine parameters menu as described in chapter 1,
- enter the parameters for the backgauge,
- scroll to parameter 29, ‘Spindle correction table’,
- press ENTER.

The following screen appears:



Each line consists of the line number, the axis position (Pos) and the necessary correction (Cor).
The table can be edited as follows:

- Use the arrow keys to move up, down, left and right.
- To add a row, go to the first column and press the ENTER key.
- To delete a row, go to the first column of the previous row and press the Clear key. All rows after the current row will be deleted!
- To enter a value, move to the required cell, type the value and press ENTER.

A maximum of 20 corrections can be programmed in the table.
For positions between the programmed positions, a correction computed through linear interpolation.

2. The machine parameters

2.1. General parameters

Parameter 13
Maximum thickness

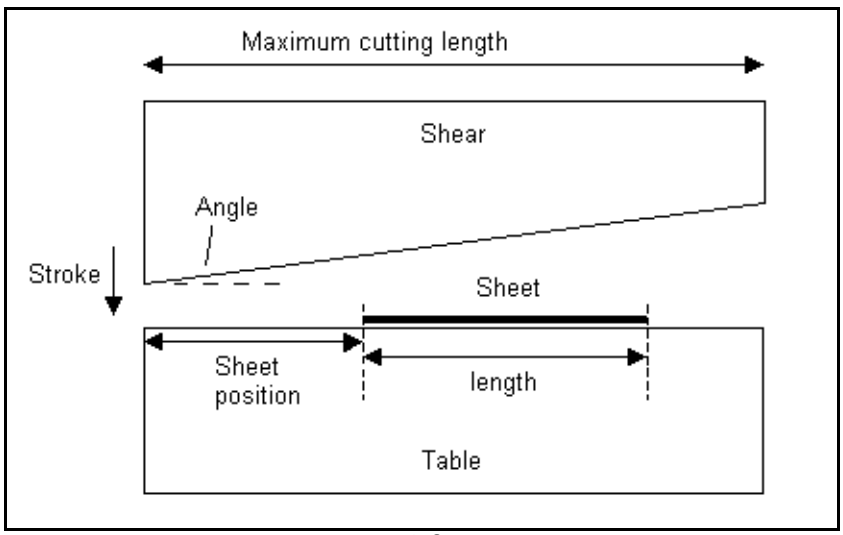
Range : 0.1 - 99.9
Unit : mm
Default : 1.0

Function
The maximum sheet thickness the machine can cut.

Parameter 14
Maximum cutting length

Range : 0.0 - 15000.0
Unit : mm
Default : 1000.0

Function
The maximum length the machine can cut. This setting will effect the maximum possible sheet length, in combination with other settings.



2.f

Parameter 15
Auto mode enabled

Range : 0 - 1
Unit : -
Default : 1

Function

When this parameter is set to 1 (default value), all operation modes are available for the operator.
When set to 0, the operation modes “Programming” and “Program selection” are not available for the operator. The other modes will remain available. The tabs of these remaining modes are aligned to the left in the Navigation bar.

Parameter 16
Enable CY

Range : 0 - 1
Unit : -
Default : 1

Function
CY indicates the step repetition parameter. When CY is enabled, this parameter is activated and can be programmed in Programming / auto mode.
0 = CY not enabled, program step repetition is not possible
1 = CY enabled, program step repetitions can be programmed.

Parameter 17
Number of FD functions

Range : 0 - 4
Unit : -
Default : 0

Function
Program the number of available function outputs. These outputs are available for general purposes. The values of these function outputs can be programmed by the operator.
If this parameter is programmed larger than 0, the parameter ‘Default value FD functions’ appears.

Parameter 18
Default FD functions

Range : 0000 - 1111
Unit : -
Default : 0000

Function
Program a default value for the function outputs. This value must be programmed as a binary number, in which each digit represents a digital function output.
This parameter only appears when the parameter ‘Number of FD functions’ is programmed larger than 0.

2.2. Backgauge control parameters

Parameter 19
Control type

Range : 0 - 3
Unit : -
Default : 3

Function
The type of motor system that is to be controlled.
0 = No control
1 = 1-speed AC or DC drive
2 = 2-speed AC or DC drive
3 = Servo motor drive
According to this setting, parameters for Servo or for AC will appear for programming. See also chapter 1 about drive types.

Parameter 20
X-speed programmable

Range : 0 - 1
Unit : -
Default : 0

Remark
Only if 'Control Type' (19) is set to 3.

Function
This parameter defines whether or not the speed of the axis can be programmed in user mode. If enabled, then in programming mode and manual mode the operator can program the axis speed in a percentage of the maximum speed.
0 = no speed parameter for operator (default setting)
1 = speed programmable

Parameter 21
Minimum value

Range : 0.00 - 9999.99
Unit : mm
Default : 1.00

Function
Minimum backgauge position. The axis will never be controlled to a lower position than programmed here.

Parameter 22
Maximum value

Range : 0.00 - 9999.99

Unit : mm
Default : 1000.00

Function
Maximum backgauge position. The axis will never be controlled to a higher position than programmed here.

Parameter 23
Manual speed high

Range : 1 - 100
Unit : %
Default : 50

Function
Speed of the axis, when it is moved in manual mode with the 'manual move' function. This is the travel speed when the arrow key is pressed continuously. This parameter should be programmed as a percentage of the maximum speed.

Parameter 24
Decimal point position

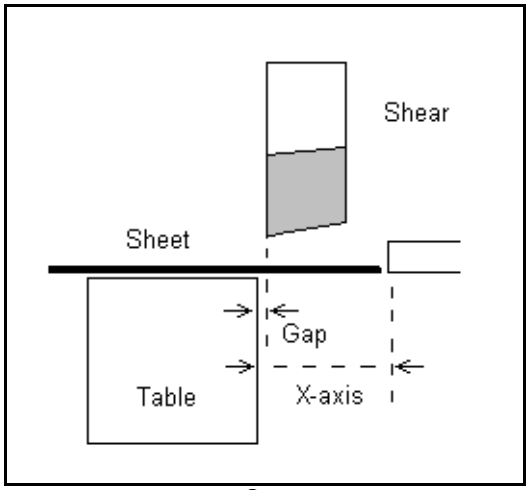
Range : 0 - 2
Unit : -
Default : 1

Function
0 = 1 mm / 0.1 inch resolution
1 = 0.1 mm / 0.01 inch resolution
2 = 0.01 mm / 0.001 inch resolution

Parameter 25
X/Gap correction enable

Range : 0 - 1
Unit : -
Default : 0

Function
When this parameter is set to 1, the position value of the X-axis is adjusted according to adjustment of the Gap.
0 = no correction
1 = correction with Gap distance



2.g

Parameter 26
Enable display correction

Range : 0 - 1
Unit : -
Default : 0

Function
When the axis reaches the programmed position, the display can show the real measured position or it can show the programmed position. This can be programmed with this parameter.
If this parameter is programmed to 1, the display shows the programmed position when the axis position is within the 'In Position' tolerance.
0 = real actual values are shown
1 = programmed value is shown when axis in position
In both cases, the value is highlighted when the axis is within the IP tolerance.

Parameter 27
X-correction enable

Range : 0 - 1
Unit : -
Default : 0

Function
To provide an X-axis correction parameter for the operator. When switched on, the operator can program a global X-axis correction that is valid for each program step.
0 = no correction parameter available
1 = X-axis correction available

Parameter 28
Pre scaling

Range : 1.000 - 9999.999

Unit : counts/mm
Default : 50.000

Function
Sets the scaling between encoder pulses and millimeters. The encoder gives an exact number of count pulses over a mm displacement. This value must be programmed here.

The value can be calculated by the formula:
F = (NP / SPP) * 4
in which:
- NP = Number of encoder pulses per revolution of the spindle
- SPP = Spindle pitch in mm

The result of the division NP/SPP is multiplied by 4, because the control counts every quadrant of one encoder cycle.

Example:
- number of encoder pulses: 50 pulse/rev.
- spindle pitch: 2 mm/rev.
results in F= (50 / 2) * 4 = 100 counts/mm

Parameter 29
Spindle correction table

Range : -
Unit : -
Default : -

Function
Entry point to edit a spindle correction table. Press ENTER to open a new window, in which the table can be edited. See chapter 3 for more information about the spindle correction table.

Parameter 30
Count direction

Range : 0 - 1
Unit : -
Default : 0

Function
To change the counting direction of the axis encoder pulses, in case the installed counting is incorrect.

Parameter 31
Reference search

Range : 0 - 1
Unit : -
Default : 1

Function
To choose whether or not to have a reference search cycle at start-up of the control.
0 = no reference search at power-on
1 = reference search
If programmed to 0, the control memorises the position when switched off. During operation, the actual position of the axis can be programmed with a parameter in the Program Constants, ‘Actual X position’.
If programmed to 1, the control will initiate a reference search cycle at start-up. In this case, several other machine parameters will appear which need to be programmed.

Parameter 32
Reference search direction

Range : 0 - 1
Unit : -
Default : 1

Remark
Only if ‘Reference Search’ (31) is set to 1.

Function
Controls the direction of the reference search.
0 = Downcounting direction.
1 = Upcounting direction.

Parameter 33
Reference position

Range : 0.00 - 9999.99
Unit : mm
Default : 900.00

Remark
Only if ‘Reference Search’ (31) is set to 1.

Function
The position of the reference switch. This position is assumed when the reference has passed. The encoder must generate a pulse from low to high on the reference input.

Parameter 34
Reference search speed

Range : 1 - 100
Unit : %
Default : 50

Remark
Only if ‘Reference Search’ (31) is set to 1.

Function
Axis speed during reference searching.

Parameter 35
RSD switch mounted

Range : 0 - 1
Unit : -
Default : 1

Remark
Only if 'Reference Search' (31) is set to 1.

Function
0: reference search system without Reference Search Direction switch (RSD-switch).
1: reference search system with RSD-switch

0
This reference procedure monitors the movement of the axis. When reference searching is started, the axis is moved at the programmed speed in the programmed direction until it is stopped by an end-of-travel (EOT) switch. Shortly after stopping, the control detects no movement on the system and controls the axis in the reverse direction. Now the control will accept the first reference pulse from the encoder and assume the reference position at that point.

1
Here an RSD switch must be connected to the RSD input of the control. When reference searching is started, the axis is moved at the programmed speed (34) in the programmed direction (32) until the control receives a signal from the RSD switch (RSD input becomes low). The control will stop movement and send the axis in the reverse direction. Now as soon as the the RSD input becomes high again, the control will accept the first reference pulse from the encoder and assume the reference position (33) at that point.
In case the RSD switch is mounted in the middle of the X-axes stroke, the control can sense the status of this switch. In case the X-axis has not passed the RSD switch, a normal reference search cycle is initiated. In case the X-axis has passed the RSD switch, the status of the RSD switch indicates that reference search can start in the direction of the RSD switch (forward). Generally you will have shorter reference search cycle time. Another advantage is the fact that it is not needed to mount the limit switches for ref.-search.

Note:
The RSD input is designed for a switch with a normally-closed contact. Low is active, high is not active.

Parameter 36
Retract programmable

Range : 0 - 1
Unit : -
Default : 0

Function
When set to 1, the retract function is enabled. Several parameters (37-40) will become available and can be programmed.

Parameter 37
Auto retract enable

Range : 0 - 1
Unit : -
Default : 0

Remark
Only if ‘Retract programmable’ (36) is set to 1.

Function
When set to 1, retract is automatically started on the high-to-low transition of the input ST, which is the moment to start cutting.
When set to 0, the backgauge is only retracted when the R input becomes high.

Parameter 38
Minimum retract

Range : 0.0 – 9999.9
Unit : mm
Default : 0.0

Remark
Only if ‘Retract programmable’ (36) is set to 1.

Function
Minimum retract value.

Parameter 39
Retract hold

Range : 0.0 - 999.9
Unit : seconds
Default : 0

Remark
Only if ‘Retract programmable’ (36) is set to 1.

Function
Holdtime, to keep the X-axis at the retract position.

Parameter 40
Default retract

Range : 0.0 – 9999.9
Unit : mm
Default : 0.0

Remark
Only if 'Retract programmable' (36) is set to 1.

Function
Default value for the retract distance when a new program is created.

Parameter 41
Safety Zone

Range : 0.0 – 9999.9
Unit : mm
Default : 0.0

Function
Safety zone for the X-axis.
If programmed to 0, this feature is not used.
If programmed higher than 0, this parameter defines a safety zone for the X-axis. During a cut, the X-axis should stay outside the zone to avoid collision.
The output XSAFE is used to indicate the X-axis status:
- TRUE if the X-axis is outside the zone (X > Safety zone);
- FALSE if the X-axis is inside the zone (X < Safety Zone).

Parameter 42
Spindle allowance

Range : 0 - 1
Unit : -
Default : 1

Function
0 = one-side positioning
1 = two-side positioning (default)
In case of two-side positioning, the axis always moves directly to the programmed position. The one-side positioning can be selected to overcome mechanical tolerances with two side positioning. In case of one-side positioning the positioning direction is from a larger to a smaller position. See also chapter 1 about drive types.

Parameter 43
Overrun

Range : 0 - 9999
Unit : mm
Default : 1

Function
Overrun distance in case of one side positioning. One-side positioning is chosen with the parameter ‘spindle allowance’(42).
An overrun is also done when an AC-drive must change position over a small distance, smaller than BLS(55). If such a situation occurs, the axis is first moved to the overrun position and then back to the required position. The overrun should not be programmed smaller than BLS. In case it is, the BLS is used as overrun.
See also chapter 1 about drive types.

Parameter 44
Overrun wait time

Range : 0 - 9999
Unit : msec
Default : 500

Function
Wait time at overrun position before the axis starts positioning in the opposite direction.

Parameter 45
Maximum operating speed

Range : 1 - 9999
Unit : mm/s
Default : 200

Remark
Only if ‘Control type’ (21) is set to 3.

Function
This is the maximum speed at which the axis will travel. Normally this value should be programmed to the maximum possible speed of the axis, when the control signal is at maximum. This value may also be programmed to a lower value, to limit the maximum speed the axis will travel.
Do not program this value higher than the axis can manage, this will have a bad effect on the control system.

Parameter 46
X-limit

Range : 0.0 - 9999.99
Unit : mm
Default : 9999.99

Remark
Only if ‘Control type’ (19) is set to 3.

Function
To define an area within which the X-axis can move at normal speed.

If the X-axis position is smaller than X-limit, the X-axis moves at normal speed. If the X-axis position is larger than X-limit, the X-axis moves at the speed, as programmed at 'Limit speed'(47).

Parameter 47
Limit speed

Range : 0.0 - 100.0
Unit : %
Default : 50.0

Remark
Only if 'Control type' (19) is set to 3.

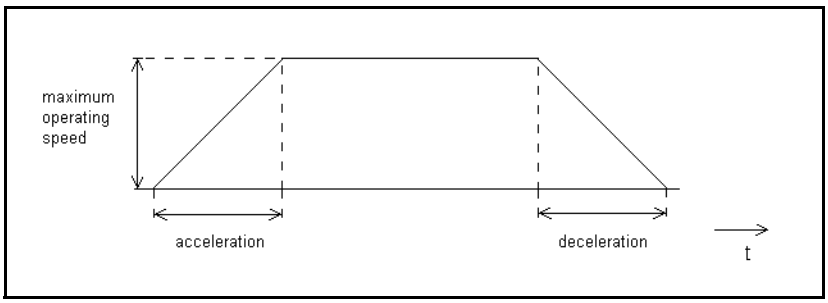
Function
Speed value at which the axis will move when the X-axis is outside the area defined by 'X-Limit(46). The speed is programmed as a percentage of the maximum speed.
This speed setting is also used when the input LSX is active.

Parameter 48
Acceleration, 0 to max.

Range : 0 - 9999
Unit : msec
Default : 200

Remark
Only if 'Control type' (19) is set to 3.

Function
This is the nominal acceleration of the axis, used to control the axis from zero to maximum speed when the axis must move to a new position. This parameter must be programmed as the time in which the axis accelerates from zero to maximum speed.



Parameter 49
Deceleration, max. to 0

Range : 0 - 999
Unit : msec
Default : 200

Remark

Only if ‘Control type’ (19) is set to 3.

Function
This is the nominal deceleration of the axis, used to control the axis from maximum to zero speed when the axis comes into position. This parameter must be programmed as the time in which the axis decelerates from maximum to zero speed.

Parameter 50
Stop decelaration

Range : 1 - 9999
Unit : msec
Default : 200

Remark
Only if ‘Control type’ (19) is set to 3.

Function
Quick deceleration of the axis in case of a forced stop.
This rate of deceleration is used when normal operation is interrupted, for instance when the stop button is pressed on the control or a forced stop has been generated.

Parameter 51
P-gain

Range : 0.0 – 9999.9
Unit : -
Default : 2.5

Remark
Only if ‘Control type’ (19) is set to 3.

Function
Proportional gain factor for the axis.
This gain factor defines the response to changes in the control signal. A high gain gives a quick response, if the gain is too high it will cause oscillation.

Parameter 52
I-gain

Range : 0 - 9999
Unit : -
Default : 1

Remark
Only if ‘Control type’ (19) is set to 3.

Function
Integral gain factor for the axis.
The I-gain is used for accurate positioning of the axis.

Parameter 53
Positioning tolerance

Range : 0.01 - 9999.99
Unit : mm
Default : 0.01

Remark
Only if ‘Control type’ (19) is set to 1 or 2.

Function
To set a range in which no new positioning takes place.
The axis will position to the new programmed position if the difference between the actual position and the new position is greater than this tolerance. If the difference is smaller the axis will stay at its actual position.

Parameter 54
AC brake enable

Range : 0 - 1
Unit : -
Default : 0

Remark
Only if ‘Control type’ (19) is set to 1 or 2.

Function
Enable the brake output ‘BRK’. This can be used to control an AC motor with brake.
0 = no brake signal
1 = enable brake signal
If this signal is used, make sure to map the brake signal to an available digital output. The brake signal is ‘low-active’: during positioning the signal is high, it will become low when the brake must be applied.

Parameter 55
Brake delay

Range : 0 - 9999
Unit : msec
Default : 0

Remark
Only if ‘Control type’ (19) is set to 1 or 2 and ‘AC Brake enable’ to 1.

Function
Delay time before AC brake is activated. The delay starts when the speed is set to 0.

Parameter 56
Brake point low speed <

Range : 0 - 9999
Unit : counts
Default : 10

Remark
Only if ‘Control type’ (19) is set to 1 or 2.

Function
Switch point from low speed to zero in the downcounting direction.

Parameter 57
Brake point low speed >

Range : 0 - 9999
Unit : counts
Default : 10

Remark
Only if ‘Control type’ (19) is set to 1 or 2.

Function
Switch point from low speed to zero in the upcounting direction.

Parameter 58
Brake point high speed <

Range : 0 - 9999
Unit : counts
Default : 100

Remark
Only if ‘Control type’ (19) is set to 2.

Function
Switch point from high speed to low speed in the downcounting direction.

Parameter 59
Brake point high speed >

Range : 0 - 9999
Unit : counts
Default : 100

Remark
Only if ‘Control type’ (19) is set to 2.

Function

Switch point from high speed to low speed in the upcounting direction.

Parameter 60
Stop time

Range : 0 - 9999
Unit : msec
Default : 0

Remark
Only if 'Control type' (19) is set to 1 or 2.
If 'AC brake enabled' (54) is set to 1, this parameter is not available.

Function
Delay time before switching off low speed after Brake point low speed (54/55) has been reached.

Parameter 61
DC low speed <

Range : 1 - 100
Unit : %
Default : 4

Remark
Only if 'Control type' (19) is set to 1 or 2.

Function
This is the output voltage for low speed movement in the negative direction. This parameter must be programmed if a DC motor drive is controlled with the analog output. It is programmed as a percentage of the maximum output voltage (10 V).

Parameter 62
DC low speed >

Range : 1 - 100
Unit : %
Default : 4

Remark
Only if 'Control type' (19) is set to 1 or 2.

Function
This is the output voltage for low speed movement in the positive direction. This parameter must be programmed if a DC motor drive is controlled with the analog output. It is programmed as a percentage of the maximum output voltage (10 V).

Parameter 63
DC high speed <

Range : 1 - 100
Unit : %
Default : 80

Remark
Only if ‘Control type’ (19) is set to 2.

Function
This is the output voltage for high speed movement in the negative direction. This parameter must be programmed if a 2-speed DC motor drive is controlled with the analog output. It is programmed as a percentage of the maximum output voltage (10 V).

Parameter 64
DC high speed >

Range : 1 - 100
Unit : %
Default : 80

Remark
Only if ‘Control type’ (19) is set to 2.

Function
This is the output voltage for high speed movement in the positive direction. This parameter must be programmed if a 2-speed DC motor drive is controlled with the analog output. It is programmed as a percentage of the maximum output voltage (10 V).

Parameter 65
Acceleration ramp

Range : 5 - 9999
Unit : msec
Default : 5

Remark
Only if ‘Control type’ (19) is set to 1 or 2.

Function
The nominal acceleration time, in which the axis accelerates from low speed to high speed. This parameter must be programmed if 2-speed DC motor drives are used.

Parameter 66
Braking ramp

Range : 5 - 9999
Unit : msec
Default : 5

Remark

Only if ‘Control type’ (19) is set to 1 or 2.

Function
The nominal deceleration time, in which the axis decelerates from high speed to low speed. This parameter must be programmed if 2-speed DC motor drives are used.

Parameter 67
Unipolar

Range : 0 - 1
Unit : -
Default : 0

Function
Function to switch unipolar control on/off. When set to 1, the analog speed output will only output a positive signal, regardless of the direction the axis is moving. This can be used to connect a frequency regulator. See also chapter 1 about unipolar control.

Parameter 68
In Position tolerance

Range : 0.01 - 9.99
Unit : mm
Default : 1.0

Function
The “in-position”(IP) output becomes active if the difference between the actual position and the programmed position is smaller than this tolerance. A cutting cycle will only advance if all axes are in position.

2.3. Angle control parameters

Parameter 69
Control enable

Range : 0 - 1
Unit : -
Default : 0

Function
Switch Angle control ON or OFF.
0 = No angle control
1 = Angle control
In case of angle control, the following I/O is used:
- digital outputs A+ and A-
- analog input AFB.

Parameter 70
Fixed angle

Range : 0.0 - 45.0
Unit : degrees
Default : 0.0

Remark
Only if the parameter ‘control enable’ (68) is set to 0.

Function
If there is no angle control, the (fixed) angle of the cutting blade can be programmed with this parameter. This value will be used for stroke and force computations.

Parameter 71
Angle tolerance

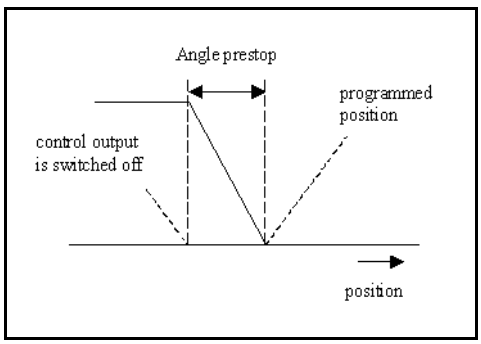
Range : 0.0 - 45.0
Unit : degrees
Default : 0.1

Function
Define the tolerance for the angle position. When the blade moves to a new angle position, positioning stops when the angle is within the tolerance and the output A_IP becomes high.

Parameter 72
Angle prestop positive

Range : 0 - 99
Unit : AD value
Default : 0

Function
Due to the inertia of the Angle system there can be some overshoot after the control output has been switched off. To prevent such overshoot, the 'Angle prestop' can be programmed. This parameter can be regarded as a programmable offset. The control will take this offset into account when positioning the Angle. When the Angle system approaches the programmed position, the control output is switched off at a certain distance (Angle prestop) before the Angle has reached position. The ‘Angle prestop positive’ must be programmed for Angle movement in the positive direction.



The value is programmed in AD-points: a converted digital value of the position feedback voltage of the potentiometer.

Parameter 73
Angle prestop negative

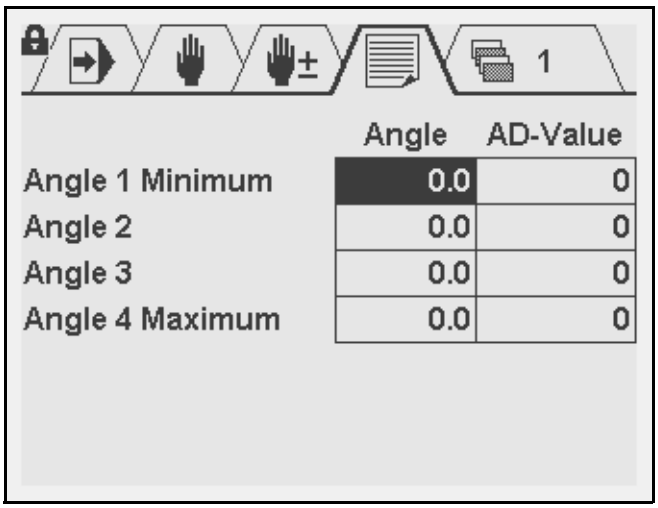
Range : 0 - 99
Unit : AD value
Default : 0

Function
This parameter has the same definition as parameter "Angle Prestop Positive" but only in the negative direction of the angle adjustment (smaller angle).

Parameter 74
Angle reference table

Range : -
Unit : -
Default : -

Function
Press ENTER to open the screen with the angle reference table. In this table, the relation between the blade angle and the feedback voltage can be programmed.



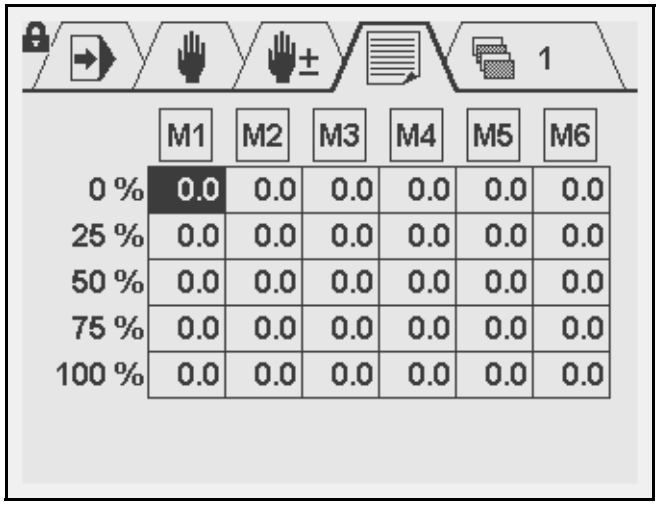
Angle: program a known angle value for the blade.
AD-value: program the required feedback voltage for this angle. The feedback voltage must be programmed in the range 0-4095, which represents the input voltage in the range 0-10V. Use the diagnostic mode to find the correct AD-values. Move the blade to and angle, measure the angle position and notice the corresponding AD-value from the analog input.

Parameter 75
Angle material table

Range : -

Unit : -
Default : -

Function
Press ENTER to open the screen with the angle material table.



	M1	M2	M3	M4	M5	M6
0 %	0.0	0.0	0.0	0.0	0.0	0.0
25 %	0.0	0.0	0.0	0.0	0.0	0.0
50 %	0.0	0.0	0.0	0.0	0.0	0.0
75 %	0.0	0.0	0.0	0.0	0.0	0.0
100 %	0.0	0.0	0.0	0.0	0.0	0.0

In this table the cutting angle can be programmed as a function of sheet thickness and sheet material. If this table is programmed, the angle is precomputed for each cutting step in a program.
The plate thickness is indicated in the vertical column, as a percentage of the maximum thickness (parameter 13, ‘Maximum thickness’). For various plate thickness values, the required angle value can be programmed.
These setpoints can be programmed for each material (column M1-M6).

2.4. Gap control parameters

Parameter 76
Control enable

Range : 0 - 1
Unit : -
Default : 0

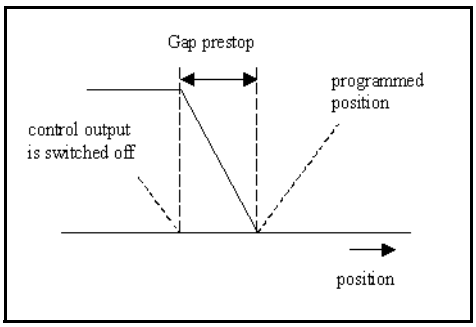
Function
Program Gap control on or off.
0 = No gap control
1 = Gap control
In case of 1, the following I/O is used:
- digital outputs G1+ and G1-
- analog input GFB.

Parameter 77
Prestop positive

Range : 0 - 99

Unit : AD value
Default : 0

Function
Due to the inertia of the Gap system there can be some overshoot after the control output has been switched off. To prevent such overshoot, the 'Gap prestop' can be programmed.
This parameter can be regarded as a programmable offset. The control will take this offset into account when positioning the Gap. When the Gap system approaches the programmed position, the control output is switched off at a certain distance (Gap prestop) before the Gap has reached position. The ‘Gap prestop positive’ must be programmed for Gap movement in the positive direction.



The value is programmed in AD-points: a converted digital value of the position feedback voltage of the potentiometer.

Parameter 78
Prestop negative

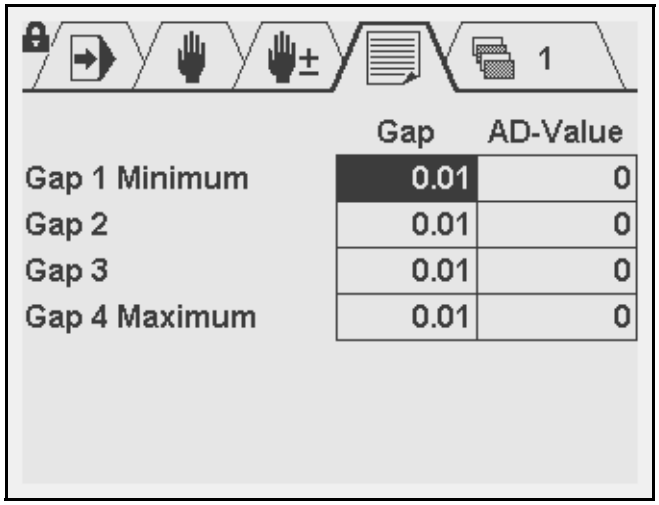
Range : 0 - 99
Unit : AD value
Default : 0

Function
This parameter has the same definition as parameter "Gap Prestop positive" but only in the negative direction of the gap adjustment (smaller gap).

Parameter 79
Gap reference table

Range : -
Unit : -
Default : -

Function
Press ENTER to open a screen with the gap reference table. In this table, the relation between the gap and the feedback voltage can be programmed



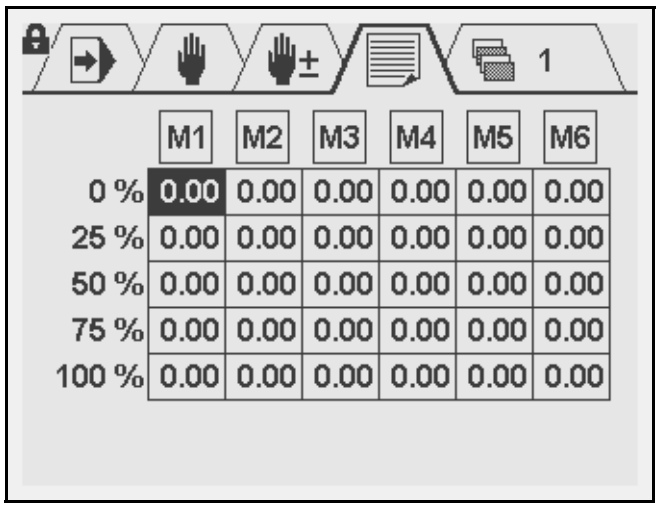
	Gap	AD-Value
Gap 1 Minimum	0.01	0
Gap 2	0.01	0
Gap 3	0.01	0
Gap 4 Maximum	0.01	0

Gap: program a known gap value for the blade.
AD-value: program the required feedback voltage for this gap. The voltage must be programmed in the range 0-4095, it will be converted to an input voltage in the range 0-10V. The adjustment procedure to find the correct AD-values is similar to the procedure for angle values as described in the previous section.

Parameter 80
Gap material table

Range : -
Unit : -
Default : -

Function
Press ENTER to open a screen with the gap material table.



	M1	M2	M3	M4	M5	M6
0 %	0.00	0.00	0.00	0.00	0.00	0.00
25 %	0.00	0.00	0.00	0.00	0.00	0.00
50 %	0.00	0.00	0.00	0.00	0.00	0.00
75 %	0.00	0.00	0.00	0.00	0.00	0.00
100 %	0.00	0.00	0.00	0.00	0.00	0.00

In this table the gap can be programmed as a function of sheet thickness and sheet material. If this table is programmed, the gap is precomputed for each cutting step in a program.

The sheet thickness is indicated in the vertical column, as a percentage of the maximum thickness (parameter 13, 'Maximum thickness'). For various plate thickness values, the required gap value can be programmed.
These setpoints can be programmed for each material (column M1-M6).

Parameter 81
Control enable

Range : 0 - 1
Unit : -
Default : 0

Function
Program control for a second gap unit (Gap2) on or off.
0 = No gap control
1 = Gap control
In case of 1, the following I/O is used:
- digital outputs G2+ and G2-
- analog input GFB.

Parameter 82
Prestop positive

Range : 0 - 99
Unit : AD value
Default : 0

Function
The same as parameter 77, but now for Gap 2.

Parameter 83
Prestop negative

Range : 0 - 99
Unit : AD value
Default : 0

Function
The same as parameter 78, but now for Gap 2.

Parameter 84
Gap2 reference table

Range : -
Unit : -
Default : -

Function

Press ENTER to open a screen with the gap2 reference table. See parameter ‘Gap reference table’ (79) for more information.

2.5. Stroke control parameters

Parameter 85
Stroke mode

Range : 0 - 2
Unit : -
Default : 0

Function
0 = No stroke option (‘Stroke length’ not available in user interface)
1 = Stroke length using timer
2 = Stroke length using analog feedback (using input ‘SFB’)
In case of 1and 2, the following I/O an be used:
- digital output EOS (End of Stroke)
- analog input SFB (only system 2)

When programmed to 2, the required stroke length in a cutting step is computed from angle setting, sheet positiom and cutting length. The user can change this as desired. The stroke position is measured through analog input ‘SFB’.
When programmed to 1, the stroke length function is handled by a timer. At parameter 87 the maximum possible stroke length is programmed, at parameter 88 the necessary time is pogrammed to reach this maximum stroke. In a cutting step, the stroke length is computed as a percentage of the maximum stroke length (parameter 87). From this, the necessary time for a stroke is computed.
When the programmed stroke length is reached during a cutting step, the EOS output becomes high.

Parameter 86
Enable sheet position

Range : 0 - 1
Unit : -
Default : 0

Function
To enable or disable the parameter Sheet position in the user interface.
0 = sheet position parameter not available (default)
1 = sheet position can be programmed.
If this parameter is programmed to 0, the sheet position for all cutting programs is always assumed 0. Other cutting parameters will be calculated accordingly.
If programmed to 1, the sheet position can be programmed. The computed stroke length and UDP point are adjusted accordingly.

Parameter 87
Minimum stroke

Range : -999 - 0
Unit : mm
Default : 0

Remark
This parameter must be programmed when ‘stroke mode’ is set to 1.

Function
This is the stroke distance when the blade is positioned on the upper dead point. Stroke position zero is defined as the upper side of the table, the minimum stroke is always negative

Parameter 88
Maximum stroke

Range : 0 - 999
Unit : mm
Default : 0

Remark
This parameter must be programmed when ‘stroke mode’ is set to 1.

Function
This is the actual stroke distance, starting at the edge of the table.

Parameter 89
Stroke time

Range : 0 - 9999
Unit : msec
Default : 0

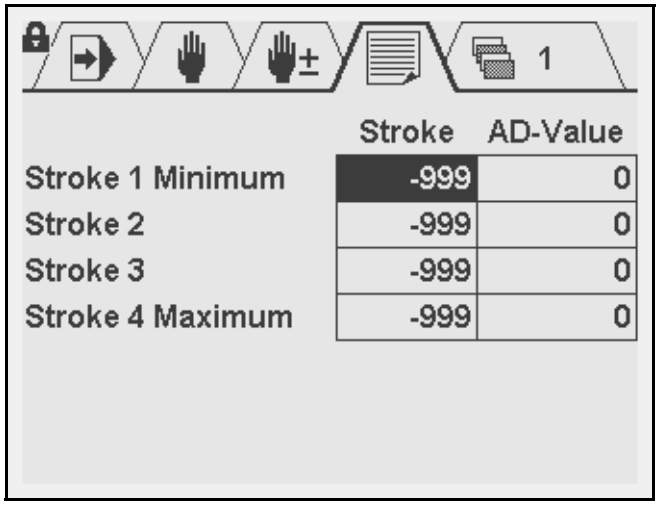
Remark
This parameter must be programmed when ‘stroke mode’ is set to 1.

Function
This is the time necessary to reach the maximum stroke length, as programmed at parameter 86. When that programmed time has elapsed, the output EOS will become active.
The user can program the desired stroke length as a percentage (0-100%) of the maximum stroke length. This percentage value can be programmed in every step with the Stroke length parameter.

Parameter 90
Stroke reference table

Range : -
Unit : -
Default : -

Function
Press ENTER to open a screen with the Stroke reference table. In this table, the relation between stroke length and feedback voltage (input SFB) can be programmed.

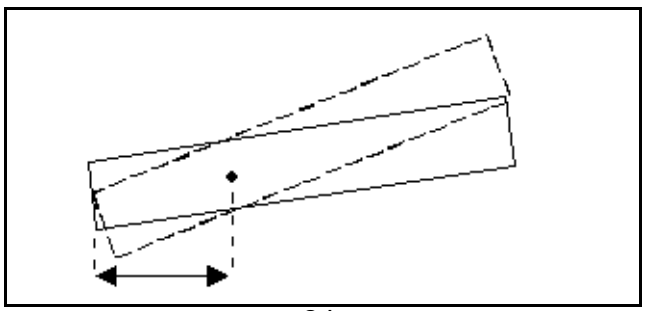


Stroke: program a known stroke value for the blade.
AD-value: program the required feedback voltage for this stroke. The input voltage must be programmed in the range 0-4095, representing an input voltage in the range 0-10V.
The adjustment procedure to find the correct AD-values is similar to the procedure for angle values as described in section 2.5.

Parameter 91
Rotation offset

Range : 0 - 9999
Unit : mm
Default : 0

Function
To program the offset of the rotation point of the blade with respect to the left side.



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Parameter 92
Prestop

Range : 0 - 255
Unit : AD-points
Default : 0

Function
To stop the shear before the computed stroke length is reached.

Due to the inertia of the system it is possible that the shear has a slight overshoot when it is stopped at the computed value. The programmed ‘prestop’-value is subtracted from the computed value, creating an EOS (end of stroke) output signal at an earlier moment than the programmed moment.

2.6. Force control parameters

Parameter 93
Main force enable

Range : 0 - 1
Unit : -
Default : 0

Function
Enable or disable cutting force on the control.
0 = no control
1 = cutting force control enabled

Parameter 94
Cutting force factor

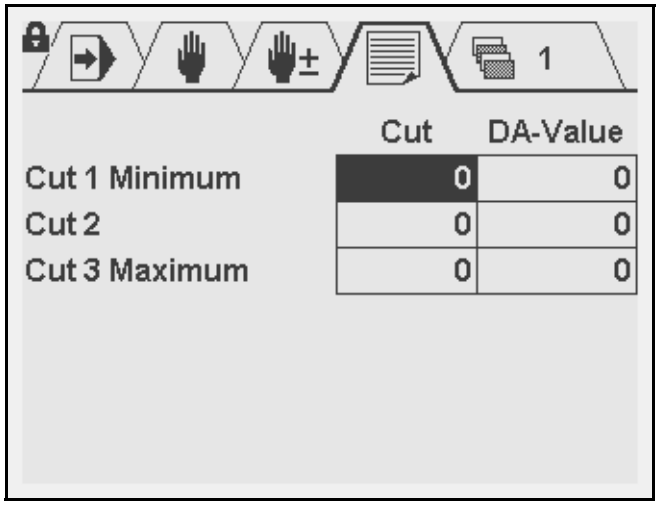
Range : 0.1 - 999.9
Unit : -
Default : 1.0

Function
The (initially) calculated cutting force is multiplied with this factor.

Parameter 95
Main force reference table

Range : -
Unit : -
Default : -

Function
Press ENTER to open a screen with the Cutting reference table. In this table, the relation between cutting force and control output voltage can be programmed.



Cut: program a known force value (in kiloNewtons) for a cut.
DA-value: program the required output voltage for this force. The output voltage must be programmed in the range 0-4095, it will be converted to an output voltage in the range 0-10V.

Parameter 96
Main force ramp

Range : 0 - 9999
Unit : msec
Default : 200

Function
This parameter describes the ramp for the main force (increase/decrease). It is programmed as the time in which the force output increases from minimum to maximum voltage.

Parameter 97
Cutting force delay

Range : 0 - 999
Unit : msec
Default : 0

Function
After the ‘ST’ input goes low, the control will start force control. This parameter can be used to program a delay before force control is started.

Parameter 98
Blade-up hold time

Range : 0 - 999
Unit : msec
Default : 0

Function

This is the time the output B_UP must remain active after UDP has been reached.

Parameter 99
Opening force

Range : 0 - 100
Unit : %
Default : 50

Function
The force for steering the blade up. This value is programmed as a percentage of the maximum force (as programmed in the reference table).

Parameter 100
Opening delay

Range : 0 - 9999
Unit : msec
Default : 0

Function
When the 'end of stroke' is reached, the control will start opening control to move the blade up. This parameter can be used to program a delay before opening control is started. An opening delay is useful to overcome the response time of the clamping system and/or the pressure control system (in case of force control).
In the timing diagrams, this delay is called T3. When ½T3 has elapsed, the signal B_UP is activated. When T3 has elapsed completely, the pressure output is activated (in case of force control).

Parameter 101
Angle/Gap force

Range : 0 - 9999
Unit : kN
Default : 0

Function
Force value in case of angle or gap control.
If the force is controlled and angle control or gap control is implemented, the main force is controlled at this value whenever angle or gap are positioned.

Parameter 102
Clamping force

Range : 0 - 100
Unit : %
Default : 0

Function

Force value for the main force during clamping. It is programmed as a percentage of the maximum main force.

Parameter 103
Clamping force delay

Range : 0 - 9999
Unit : msec
Default : 0

Function
Delay before the output is controlled for clamping.

Parameter 104
Clamping time

Range : 0 - 9999
Unit : msec
Default : 0

Function
The time the main force output stays active for clamping.

Parameter 105
Clamping force enable

Range : 0 - 1
Unit : -
Default : 0

Function
Enable or disable separate clamping force on the control.
0 = no control
1 = clamping force control enabled

Parameter 106
Clamping force ramp

Range : 0 - 9999
Unit : msec
Default : 200

Function
This parameter describes the ramp for the clamping force (increase/decrease). It is programmed as the time in which the force output increases from minimum to maximum voltage.

Parameter 107
Clamping force delay

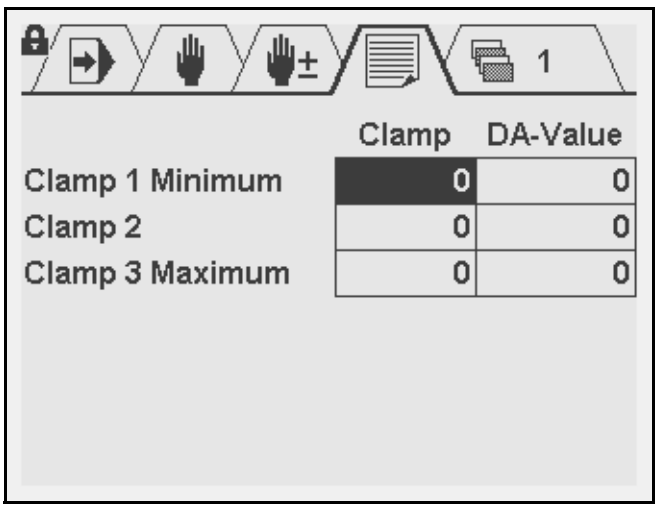
Range : 0 - 999
Unit : msec
Default : 0

Function
After the 'ST' input goes low, the control will start force control. This parameter can be used to program a delay before force control is started.

Parameter 108
Clamping reference table

Range : -
Unit : -
Default : -

Function
Press ENTER to open a screen with the Clamping reference table. In this table, the relation between clamping force and control output voltage can be programmed.



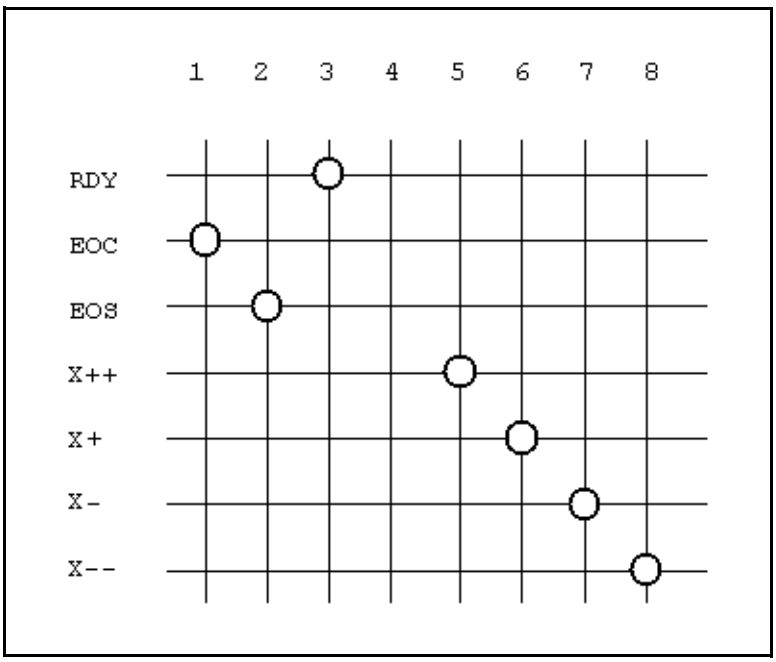
Cut: program a known force value (in kiloNewtons) for a cut.
DA-value: program the required output voltage for this force. The output voltage must be programmed in the range 0-4095, it will be converted to an output voltage in the range 0-10V.

3. I/O assignments

3.1. Inroduction

The control has several programmable features. These features can be enabled or disabled in software. Depending on these featues, a number of logical signals can be mapped to the I/O pins of the control.
This means the system programmer can enable the necessary signals and assign them to output pins. The I/O settings should be adjusted by authorized personnel only.

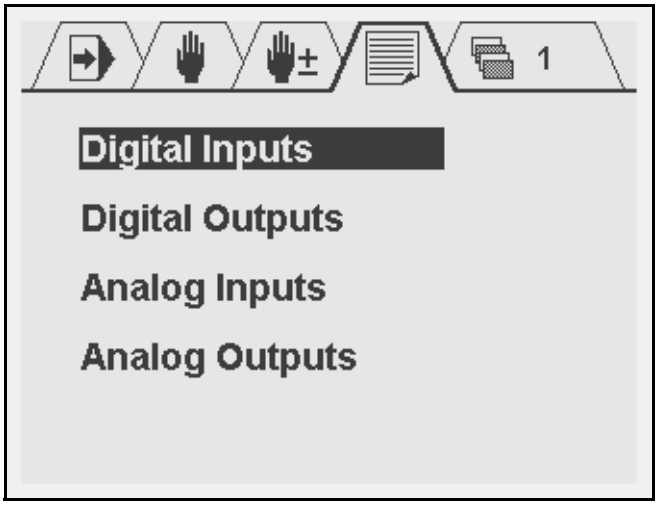
Example:



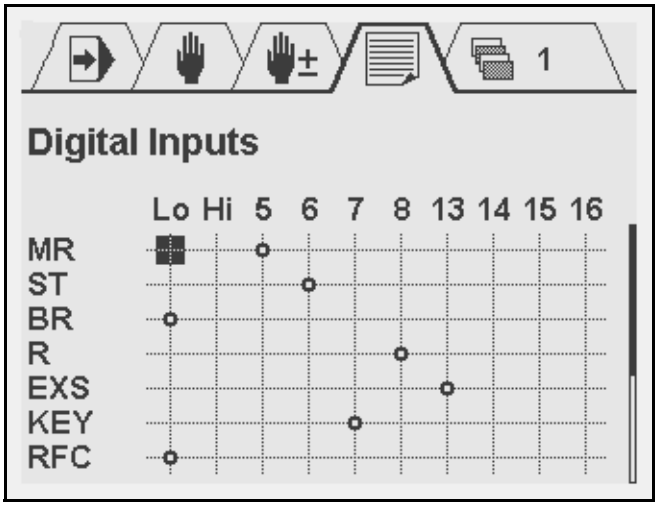
The example picture above shows an example of a possible mapping of output pins. In the picture, pins 5 - 8 are allocated for the movement of a 2-speed AC drive, fast and slow in both directions. If the system has a servo drive, those signals are not necessary. Then you could delete these connections (the intersections) and use output 5 - 8 for other pusposes.
See also the schematics in part I of this manual for connection examples.

To enter the I/O allocation mode:
- enter the machine parameter menu as described in chapter 1;
- scroll to the menu ‘IO mapping’ and press ENTER.

The following screen appears:



Each choice opens a sub-menu with an array of the logical signals and available connector pins. The screen for digital inputs looks as follows:



In the top row, the available connector pins are shown. In the left column, the logical signals are listed. The symbol indicates that there is a connection between the pin and the logical signal. A signal is linked to an input pin as follows:

- move the cursor with the arrow keys and +/- keys to the necessary intersection;
- press ENTER.

To erase a connection, go to it with the cursor and press ENTER. The connection will disappear.
The numbers 5-8 and 13-16 refer to the digital inputs of the DAC. ‘0’ is a logical FALSE. If a signal is linked to this, it is always regarded as low (not active). ‘1’ is a logical TRUE. If a signal is linked to this, it as always regarded as high (active).
For digital outputs the method works similar. In the case of outputs, several logical signals can be mapped to the same output pin. They are processed as a logical OR: if one or more of these signals become high, the output pin becomes high.

3.2. List of I/O signals

Digital input signals

Code	Name	Description
UDPIN	UDP input	Input to indicate blade is in the mechanical Upper Dead Point.
MR	Machine Ready	Signal that indicates the machine is ready. When it is low, the control cannot be started and digital outputs and pressure outputs are disabled. When it is high, the control can be started and the Hours counter (parameter 91) keeps track of the time.
ST	Step input	Input to change step
PEDAL	Start cut	Input for external signal to start cut
BR	Blade Return	Independent input to move the cutting blade up, typically used for pushbutton
R	Retract	Retract request signal. The Retract signal is only accepted during part of a cutting cycle. Please see the timing diagram to check the supported interval, as indicated by 'RetractEnable'.
EXS	External Start	Input to start the control
X_RES	Reset X	Reset X position to 0 (support decoiling)
KEY	Program enable	Signal to block or enable programming on the control.
RFC	Reference correction	Input signal for position correction. If high, the current position value is copied from the currently programmed position.
G2_ST	Start Second gap	Start input for second gap.
G1_ST	Start first gap	Start input for first gap.
A_ST	Start Angle	Start input for angle.
X_ST	Start backgauge	Start input for backgauge.
RSD	Reference Search Direction input	Input for reference switch for X-axis.

Digital output signals

Code	Name	Description
UDP	Upper Dead Point	Upper Dead point has been reached.
RDY	Ready	Ready signal, to indicate that the control has finished positioning. In case of a shear system, this signal becomes high when the axis is in position and the Gap and Angle are set correctly. The RDY signal will remain high during retract.

NCS	NC Start	Control is started.
EOS	End Of Stroke	Stroke is finished, either position is reached or stroke time has elapsed
EOC	End Of Cycle	Program step is finished
F1	Function output 1	General purpose programmable output
F2	Function output 2	General purpose programmable output
F3	Function output 3	General purpose programmable output
F4	Function output 4	General purpose programmable output
SC0	Stock Counter 0	Stock counter has reached 0 after downcounting
B_UP	Blade up	Move blade up
B_DN	Blade down	Move blade down
CLAMP	Clamping force	Indicate clamping pressure is active
XSAFE	X at safe position	Indicate X-axis is outside safety zone
G2_OK	Gap 2 OK	Gap 2 control ready
G2_IP	Gap 2 IP	Gap 2 in position
G2+	Gap2 open	Increase gap2 opening
G2-	Gap2 close	Reduce gap2 opening
G1_OK	Gap 1 OK	Gap 1 control ready
G1_IP	Gap 1 in position	Gap 1 in position
G1+	Gap open	Increase gap opening
G1-	Gap close	Reduce gap opening
A_OK	Angle control ready	Angle control circuitry ready
A_IP	Angle in position	Blade has reached correct angle
A+	Angle increase	Increase angle between table and shear
A-	Angle decrease	Reduce angle between table and shear
X_OK	X-axis ready	X-axis control ready
X_IP	Backgauge in position	X-axis has reached position
X++	Fast opening	Fast opening command for AC motor X-axis
X+	Opening	Opening command for AC motor X-axis
X-	Closing	Closing command for AC motor X-axis
X--	Fast closing	Fast closing command for AC motor X-axis
BRK	Brake (AC)	Brake signal for AC motor, equipped with brake system. This signal is ‘low-active’: during positioning the signal is high, it will become low when the brake must be applied.

Analog input signals

Code	**Name**	**Description**
SFB	Stroke Feedback	Position feedback of the shear, in case Stroke feedback is enabled.

GFB2	Gap2 feedback	Position feedback of the Gap2 opening, in case Gap system with position feedback is enabled.
GFB1	Gap1 feedback	Position feedback of the Gap1 opening, in case Gap system with position feedback is enabled.
AFB	Angle feedback	Feedback of angle value, in case angle control is installed.

Analog output signals

Code	Name	Description
CF	Cutting force	Control signal for the main pressure valve, which is used for various pressure control functions
CLF	Clamping force	Control signal for clamping pressure valve

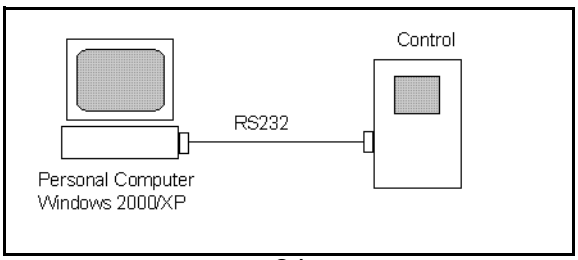
4. Software settings

4.1. Parameter back-up

The control has various data stored in its memory: program parameters, machine parameters and I/O settings.
This data can be stored on a PC or it can be restored from a PC. Examples:

- If the control settings have become erratic, a set of default settings can be restored from the PC.
- If you have a number of controls that need the same settings, you only need to program one control and save its settings. After that, all other controls can import these settings from the PC.
- If your control is to be upgraded with new software, you should save your settings. When the control is upgraded, all settings are set back to default values. After the upgrade, you can restore your settings from the PC.

The PC and the control are connected with each other through a serial link. To save or retrieve this data, the following set-up is used:

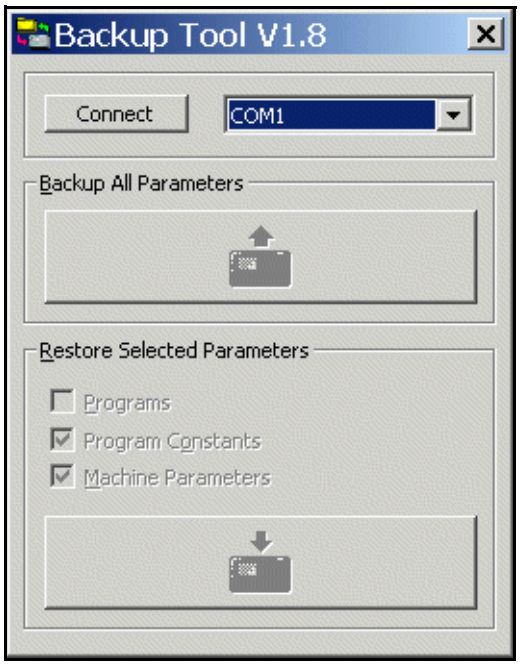


2.i

The following equipment is required:

- a Personal Computer, equipped with Windows 2000 or higher;
- serial cable, RS-232 (Delem DNC);
- Delem back-up software for transmission of machine settings.

The Delem back-up software must be installed on the PC. All actions, storage and restoration of settings, are done with this program. Just make sure the necessary cables are connected and the DAC control is switched on.
To start the back-up tool, simply double-click its icon. A window appears:



After start-up, the two large buttons for back-up and restore cannot be selected yet. First, click on the button 'Connect...' to establish a connection between the software and the DAC control. If not succesful, select a different serial port (COM1, COM2, etc.) and try again. If this still gives no positive result, check your cabling.
When the connection is established, the two buttons will be coloured to indicate they are enabled.
To store the control settings on the PC:

- click the button 'Backup';
- in the dialogue, select a filename and a location for the file with control settings.

To load control settings into the control:

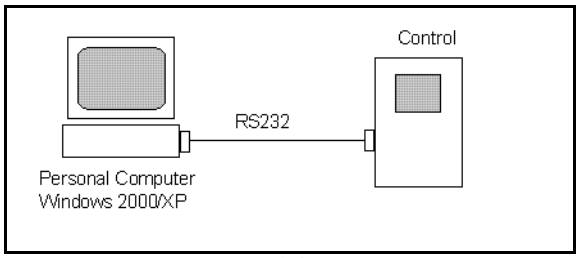
- click the button 'Restore';
- in the dialogue, select the file with control settings that must be loaded.

A back-up operation includes all data that is present on the control.
A restore operation offers the possibility to restore only specific data to the control. As shown above, several types of data can be selected for restoration.

- Program Parameters: all production parameters for the operator, step parameters, etc.
- Program Constants: some program settings for the operator.
- Machine Parameters: machine settings of the control, as described in chapter 1. This includes the IO Configuration as described in chapter 2.

4.2. Upgrade control

The control can be updated with new software. For this procedure, you need the same set-up as described in the previous section:



2.j

In order to perform a succesful update, the RS-232 cable must be connected to the first serial port of the PC (COM1).
You also need a program that will load the new software into the control. This program can be requested from Delem.

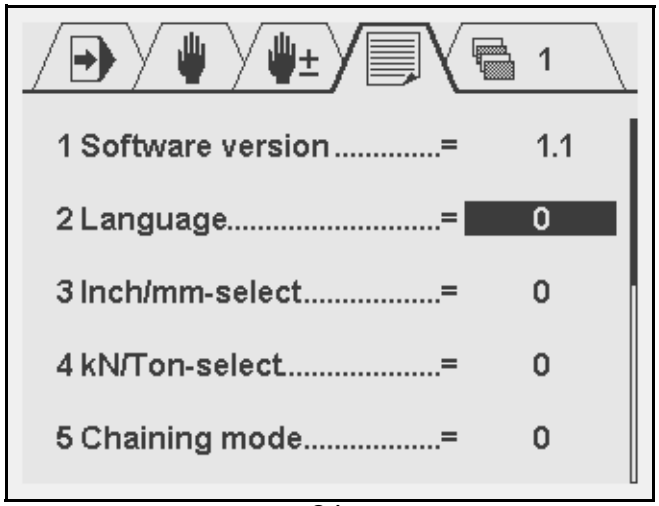
Note: before starting an update, first perform a back-up of your control settings. When the control is updated, all data is erased and the control is reset to factory default settings. See the previous section for more information about back-up and restore.

Make sure the necessary cables are connected and the DAC control is switched on. To perform the update, double-click the program icon. The Update program will appear in a new window.

Check if you have made a back-up of your control settings. Then click on the ‘Update’ button to load the new software into your control.
The control is updated. A ‘progress bar’ inside the window will indicate the progress. When the update is completed, the message ‘Update successfull’ appears in a new window. Press ‘Exit’ to finish the program.
When the update is finished, the control is reset to default settings. If necessary, use the Backup Tool to restore the saved settings.

4.3. Special access codes

There are several access codes to enter special menus of the control. These access codes should only be known and used by authorised service personnel.
Each code is entered on the page of the program constants, when the cursor is on the parameter Language.



2.k

The following codes are available:

852
Use this code to enter the machine parameter menu. See also chapter 1.

741
Use this code to enter the diagnostic mode of the control. See part III of this manual.

123123
Use this code to reset the hours counter and stroke counter to zero, e.g. after the system has had a maintenance check.

684684
Use this code to reset all control data to default values. All previous settings are lost: machine parameters, I/O settings, programmed products and tools.

Warning: when this code is entered, all programmed products and tools in the control are lost! You should make a backup of all data before entering this reset code.

4.4. Display codes

In the upper richt corner of the screen, a status code is shown that indicates the current status of the control. Such a code can either be a status code or and error code.

The following table shows the possible status codes:

S0	Stopped	Waiting for the operator to press start while pump start is high
S1	Positioning	Not all axes are in position yet
S2	Wait for ST low	Waiting for STEP input falling edge
S3	Wait for EOS	Wait for EOS, generated by potentiometer or BR
S4	Wait for UDP	Wait for UDP, generated by potentiometer or STEP input
S5	Wait for STEP high	Waiting for STEP input rising edge
S6	Wait for end of retract	Waiting for end of retract when STEP is already high.
S7	Wait for safe X	Waiting until X-axis is in safe area

The following table shows the possible error codes:

E1..	Internal error (1)
E21	Power supply failure
E23	Encoder 1 error
E24	Encoder 2 error
E53	Invalid parameters
E56	No movement on X-axis
E57	No movement on A-axis
E58	No movement on G1-axis
E59	No movement on G2-axis
E94	Internal error (1)

(1) If this error occurs, reboot the control. If the error persists, contact your machine supplier.

Part III - Diagnostic program

To be able to test a DAC-360 control, it has been equipped with a diagnostic program.

1. Introduction

1.1. Remarks

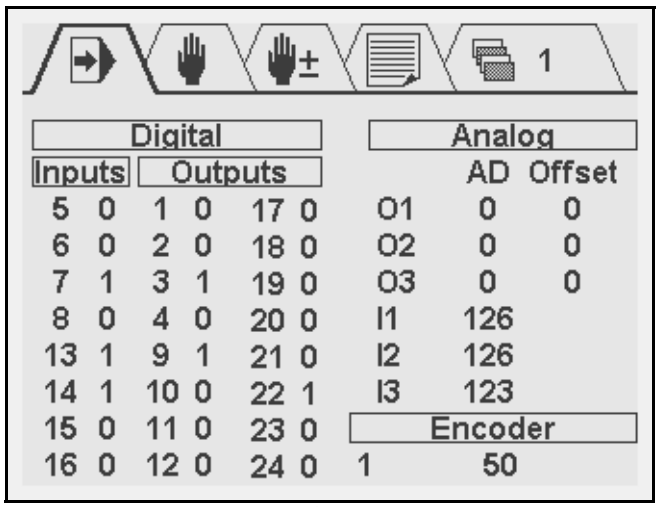
With the test functions of the diagnostic program a service engineer can test the control and the interfacing with the system.
Before starting the diagnostic program it is wise to check the machine for moving parts. This is because during the diagnostic operation of the control no regulation of the axis is performed. With the diagnostic program you have to be careful because all I/O is controlled. All digital and analog outputs can be activated for motor movement or relay switching.

1.2. Test-menu

To select the diagnostic program the following steps have to be performed:

- Move the cursor to the program constants,
- select the parameter ‘language’,
- Type access code 741 and press ENTER.

The diagnostic screen of the control looks as follows:



3.a

To end the diagnostic program with the 'STOP'-key. The control application will restart.

1.3. Test functions

Digital Inputs 5 - 8, 13 -16
These digits refer to the digital inputs of the control. To test the digital inputs, apply 24V to the inputs and check if they change to '1'.

Digital Outputs 1-4, 9-12, 17-24
These digits refer to the digital outputs of the control. To change an output, move the cursor to the required output number and press ENTER.

Analog
Column with several analog I/O signals, inputs and outputs.
The analog output voltages can be set between -10V and 10V with the left and right arrow keys or by typing a DA-value. These are 12-bit values between -4095 and 4095. The offset voltage can be programmed in the same manner.
The analog inputs accept voltages between -10V and 10V. The voltage is indicated with 12-bit values between -4095 and 4095.

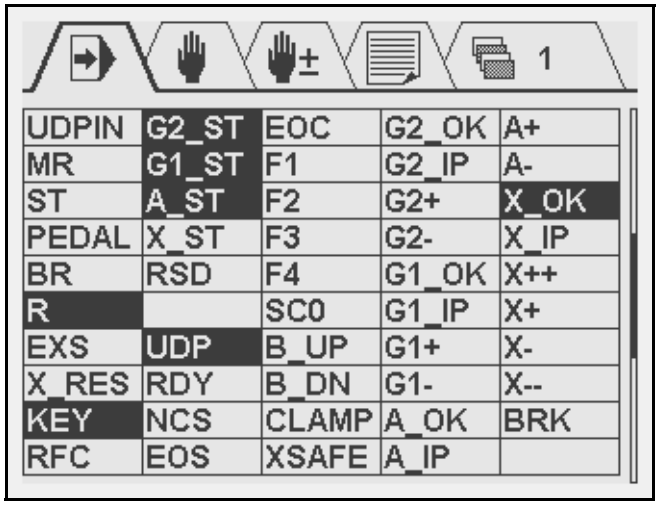
Encoder
Test the encoder input and the encoder counting. Use the ‘Ref’ field to check the encoder reference signal. When switched on, the input will accept a reference pulse from the encoder. When switched off, the input will ignore any reference pulse.

1.4. Service screens

The control status and I/O behaviour can also be monitored in the operation modes. In these modes, several service screens can be activated. The service screens are available in Automatic mode and Manual mode.
There are three service screens:

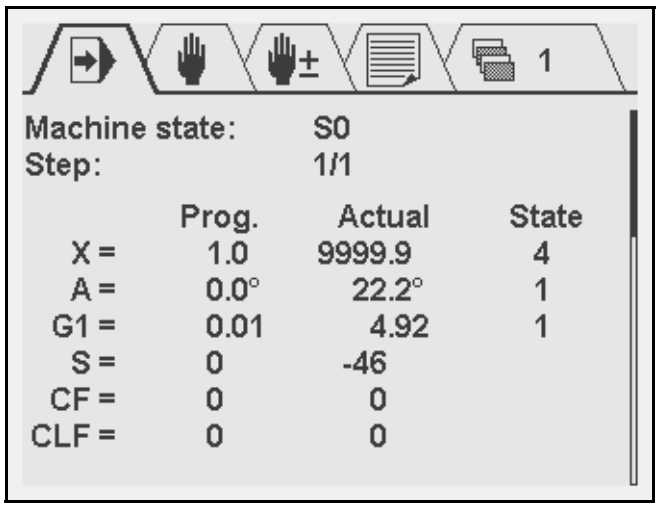
- control status
- signal status
- I/O status

When the control is stopped, a service screen is opened by pressing the Stop key continuously. When the control is started, a service screen is opened by pressing the Start key continuously.
The service screen appears.



UDPIN	G2_ST	EOC	G2_OK	A+
MR	G1_ST	F1	G2_IP	A-
ST	A_ST	F2	G2+	X_OK
PEDAL	X_ST	F3	G2-	X_IP
BR	RSD	F4	G1_OK	X++
R		SC0	G1_IP	X+
EXS	UDP	B_UP	G1+	X-
X_RES	RDY	B_DN	G1-	X--
KEY	NCS	CLAMP	A_OK	BRK
RFC	EOS	XSAFE	A_IP	

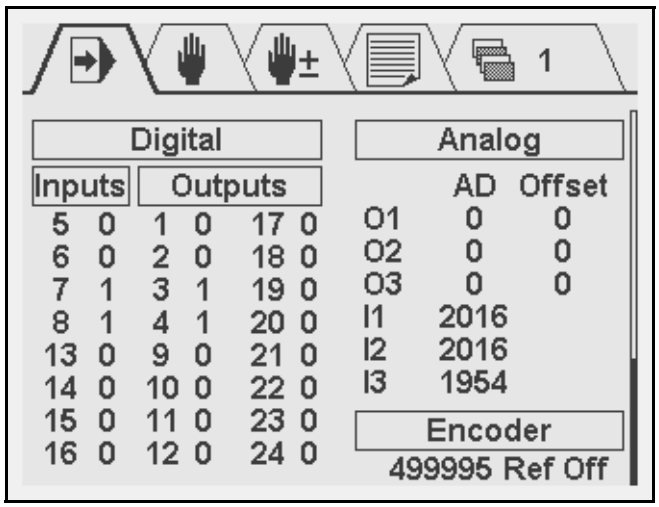
In this screen, the status of all internal I/O signals is shown.



Machine state: S0
Step: 1/1

	Prog.	Actual	State
X =	1.0	9999.9	4
A =	0.0°	22.2°	1
G1 =	0.01	4.92	1
S =	0	-46	
CF =	0	0	
CLF =	0	0	

In this screen, the programmed and actual values of parameters is shown.



Digital

Inputs		Outputs			
5	0	1	0	17	0
6	0	2	0	18	0
7	1	3	1	19	0
8	1	4	1	20	0
13	0	9	0	21	0
14	0	10	0	22	0
15	0	11	0	23	0
16	0	12	0	24	0

Analog

	AD	Offset
O1	0	0
O2	0	0
O3	0	0
I1	2016	
I2	2016	
I3	1954	

Encoder
499995 Ref Off

In this screen, the status of all physical I/O is shown.

A program (step) can be started in order to view the I/O behaviour. In the service mode, it is not possible to program parameters or I/O.
Press the keys <arrow down> and <arrow up> to browse through the service screens.