CONTROL TECHNIQUES

User Guide

Winder

solutions

Software for
Unidrive-SP

Part Number: SSP-3200-0010
Issue Number: 4

www.controltechniques.com

Safety Information

Persons supervising and performing the electrical installation or maintenance of a Drive and/or an external Option Unit must be suitably qualified and competent in these duties. They should be given the opportunity to study and if necessary to discuss this User Guide before work is started.

The voltages present in the Drive and external Option Units are capable of inflicting a severe electric shock and may be lethal. The Stop function of the Drive does not remove dangerous voltages from the terminals of the Drive and external Option Unit. Mains supplies should be removed before any servicing work is performed.

The installation instructions should be adhered to. Any questions or doubt should be referred to the supplier of the equipment. It is the responsibility of the owner or user to ensure that the installation of the Drive and external Option Unit, and the way in which they are operated and maintained complies with the requirements of the Health and Safety at Work Act in the United Kingdom and applicable legislation and regulations and codes of practice in the UK or elsewhere.

The Drive software may incorporate an optional Auto-start facility. In order to prevent the risk of injury to personnel working on or near the motor or its driven equipment and to prevent potential damage to equipment, users and operators, all necessary precautions must be taken if operating the Drive in this mode.

The Stop and Start inputs of the Drive should not be relied upon to ensure safety of personnel. If a safety hazard could exist from unexpected starting of the Drive, an interlock should be installed to prevent the motor being inadvertently started.

General Information

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation or adjustment of the optional operating parameters of the equipment or from mismatching the variable speed drive (Drive) with the motor.

The contents of this guide are believed to be correct at the time of printing. In the interests of a commitment to a policy of continuous development and improvement, the manufacturer reserves the right to change the specification of the product or its performance, or the contents of this guide, without notice.

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Issue Code: 2

Contents

1 Introduction

1.1 Who Should Read This Manual?

This manual is intended to assist the engineer in commissioning the application software, and should be read in conjunction with the documentation that is supplied with the drive and other associated hardware. The safety systems that are required to prevent risk of injury to persons operating or maintaining the machine are not discussed in this manual. The engineer must be familiar with and able to implement the required safety systems. This manual assumes that the engineer is familiar with relevant Control Techniques products and understands the requirements for the application.

If you do not feel confident of the above, then you should contact your local Control Techniques drive centre or distributor to obtain service / advice.

1.2 Application Overview

The Control Techniques Centre Wind software package has been developed with the objective of simplifying the set up and commissioning of centre wind systems. It is designed to handle a wide range of centre wind applications and is suitable for both rewind and unwind functions. It can be configured to operate in open or closed loop torque mode with feedback normally from a load cell but possibly a suitably calibrated dancing roll, or in closed loop speed control mode with feedback from either a dancing roller.

Features provided within the package include:

- All Data entry for set up in Engineering Units
  - Option of Metric or U.S. Standard Units
- Set point data in digital or analog format
- Dedicated process data registers allow high speed data input via field bus
- Tension control using Torque Mode or Speed Mode
- PID trim in conjunction with load cell or dancer feedback
- Diameter calculation using Speed ratio or Lap count
  - Option within lap count for operation with traverse systems
- Alternative of direct diameter measurement via analog input.
- Inertia compensation for fixed and variable inertia components
- Fixed and dynamic loss compensation
  - Two point or multipoint profile shaping
- Tension profiling to achieve Taper with adjustable taper start point
  - Linear or Hyperbolic profiles available
- Automatic adjustment to suit both constant torque and constant power motors
- Analog or serial data input or a combination of both
- User configurable I/O allows use with discrete control devices MMI or PLC via parallel or serial interface
- Web break detection
- Analog output for Dancer pressure regulating systems
- Non volatile storage of diameter on power down

1.3 Engineering Units used in this software

Input & display data	Metric 18.50 = 0	US Standard 18.50 = 1
Diameter	Millimetres	Tenths of an inch
Width	Millimetres	Inches
Density	Kg / m^3	Pounds per cubic foot
Inertia	Kg / m^2	Pounds feet ^{2}
Gauge	Microns	Thousandths of inch
Line Speed	Metres per minute	Feet per minute
Centreing speed	Centimeters per minute	Inches per minute
Acceleration	Metres per minute per second	Feet per minute per second
Tension	Newtons	Pounds
Torque	Newton metres	Pounds feet

NOTE The main algorithms of this software operate in Metric units, therefore when US standard units are used each applicable parameter is converted internally to metric. Due to the conversion factors used, this introduces limitations with the minimum settings of some of the parameters.
For example:
Line speed minimum setting is 4ft/min
(Conversion factor 3.28ft/min to 1m/min)
ANY VALUE SET BELOW WILL BE O.

1.4 Sizing the Motor and Drive Module

Winder motors should always be sized from knowledge of the required winding tension and line speed

$$\textbf{Winding tension power (kW)} = \frac{\textbf{Line speed} \times \textbf{Total tension pull}}{\textbf{60000}}$$

Where line speed is in Metres per minute and Tension is in Newtons.

Or, using US Standard units

$$\textbf{Winding tension power (HP)} = \frac{\textbf{Line speed} \times \textbf{Total tension pull}}{\textbf{5252}}$$

Where line speed is in feet per minute and Tension is in pounds force.

If constant torque control is to be employed, then the motor and converter should be rated:

$$\textbf{Motor/Convertor (kW)} = \textbf{Winding tension power (HP)} \times \frac{\textbf{Maximum diameter}}{\textbf{Minimum diameter}}$$

$$\textbf{Motor speed (r/min)} = \frac{\textbf{Line speed (m/min)} \times \textbf{Gear ratio}}{\textbf{Pi} \times \textbf{Minimum diameter (metres)}}$$

This will ensure that the drive can produce the torque required at maximum diameter and the speed required at minimum diameter.

Constant power applications are best specified by stating, the power and speed requirements at both ends of the diameter range. If a combined constant power / constant torque application is involved then the speed and power requirement at base speed should also be quoted. If a constant torque region is to be provided ensure that the drive controller is up-rated accordingly.

Any additional power required to overcome transmission losses and provide peaks for acceleration should be added to the above result.

It is essential that the motor and drive are correctly matched to the power requirement of the winder to ensure optimum control resolution.

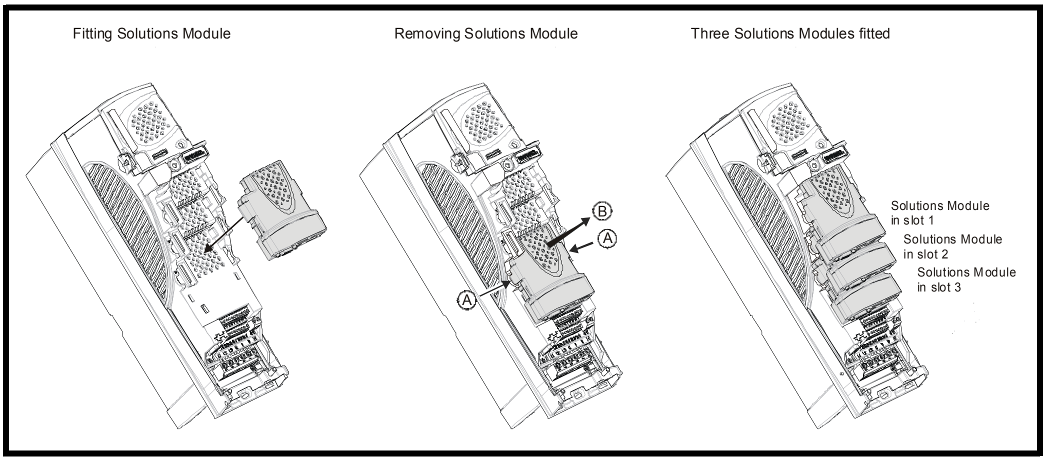
2 Mechanical Installation

NOTE Ensure the Unidrive-SP is correctly installed in accordance to the Unidrive-SP Installation Manual.

2.1 Fitting of Option Modules

Unidrive-SP 'SM' option modules are truly universal and can be fitted to any of the 3 option slots provided on the drive. The following procedure is applicable for all the 'SM' option modules

- Isolate the Drive from the main supply and allow 5 minutes for the DC Bus capacitors to discharge.
- To insert the SM option module, press down in the direction shown below until it clicks into place. The option module can be inserted into any of the 3 universal slots.
- To remove the SM option module, press inwards at the points shown (A) and pull in the direction shown (B).
- The Unidrive-SP must be disconnected from the mains supply before installing or removing an option module.



3 Electrical Installation
3.1 Unidrive-SP
3.1.1 Control

+24V digital supply (Terminal 22)

Supply for external digital signal devices

Voltage Tolerance:	±10%
Nominal output current:	200mA
Overload output current:	240mA
Protection:	Current fold-back above 240mA

+10V analog supply (Terminal 4)

Supply for external analog signal devices

Voltage Tolerance:	±1%
Nominal output current:	10mA
Protection:	Current limit and thermal trip

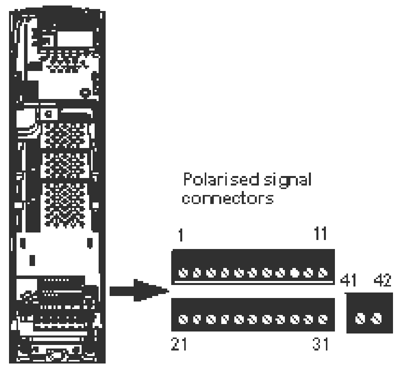
3.2 Power / Motor Connections

Please refer to the Unidrive-SP documentation for the relevant information regarding:

- Voltage Rating
- Current rating
- Motor Connections
- Encoder / Resolver Connections

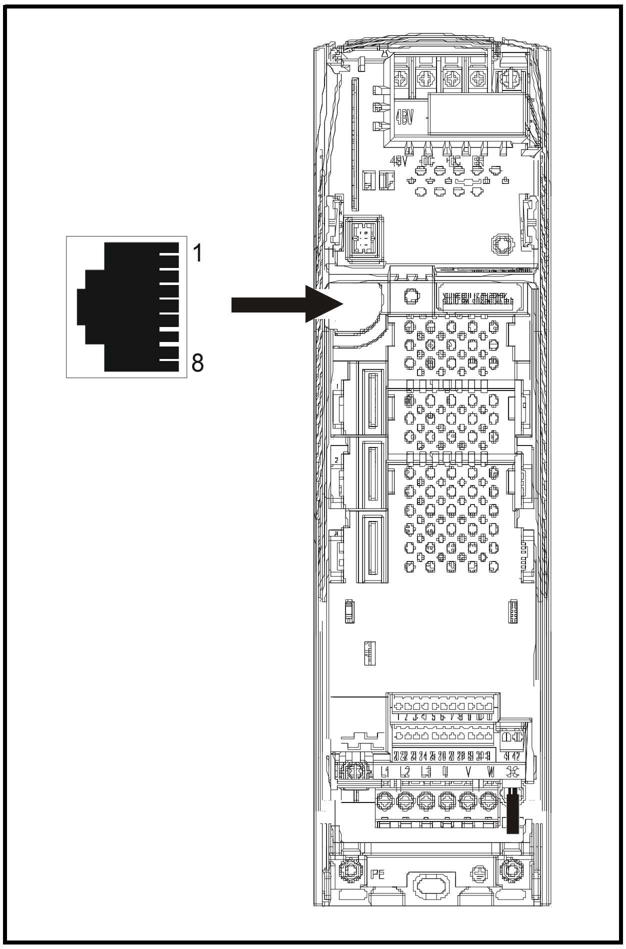
3.3 Connector Location

3.3.1 Unidrive-SP Control Terminal Connections



Term	Function
1	0V Common
2	24Vdc external Input supply
3	0V common
4	+10Vdc Analog supply
5	Analog Input 1 (Non-Inverting)
6	Analog Input 1 (Inverting)
7	Analog Input 2
8	Analog Input 3
9	Analog Output 1
10	Analog Output 1
11	0v common
21	0v common
22	24Vdc user output supply
23	0v common
24	Digital I/O 1
25	Digital I/O 2
26	Digital I/O 3
27	Digital Input 1
28	Digital Input 2
29	Digital Input 3
30	0v common
31	Drive Enable
41	Relay Output
42	

3.3.2 Unidrive-SP RS485 Port

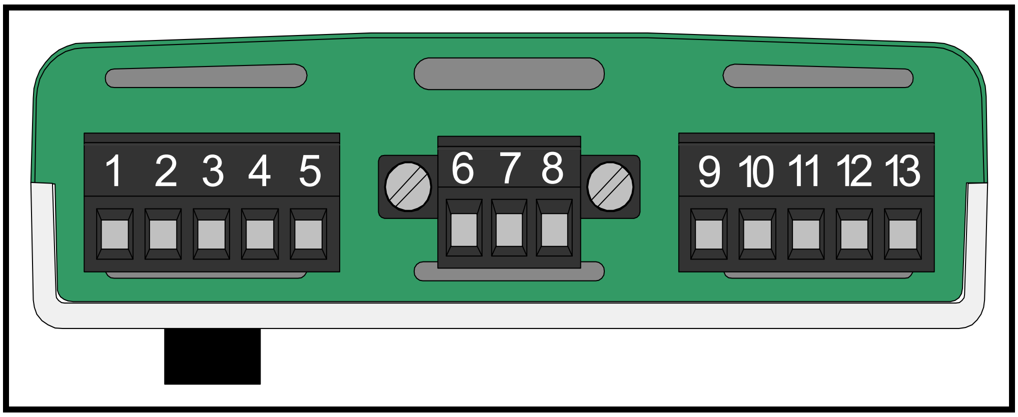


RJ45 Connector Pin out

Term	Function
1	Terminating Resistor
2	RX - TX EIA-RS485
3	0V
4	24Vdc
5	Not used
6	Tx Enable
7	/Rx - /Tx EIA-RS485
8	Linked to pin 7

3.3.3 Application Module Connections

The SM-Applications module has a single 17-way screw terminal block.

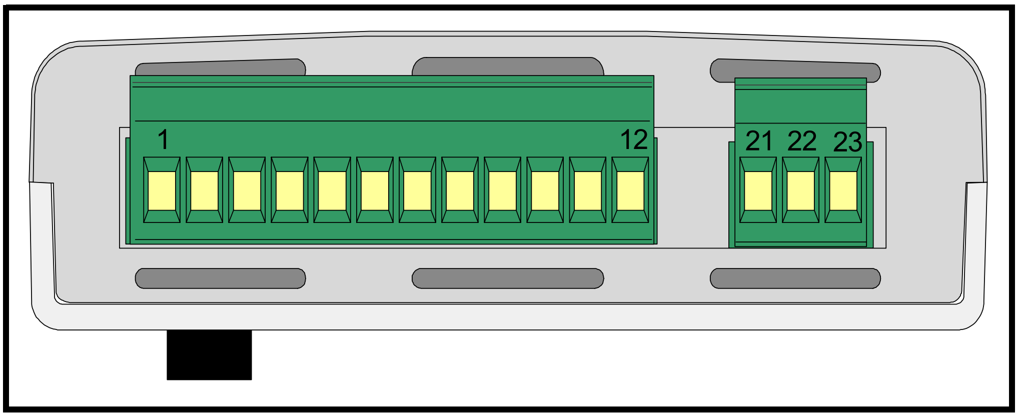


SM-Applications Module - Front View

The terminals are numbered from terminal 1 on the left hand side to terminal 17 on the right. The terminal functions are given in the table below:

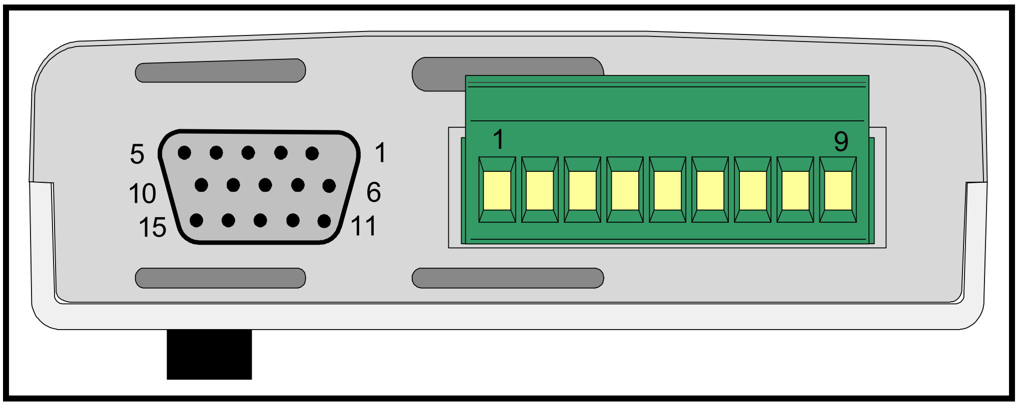
Term	Function	Description
1	0V SC	0V connection for RS485 port
2	/RX	EIA-RS485 Receive line (negative).
3	RX	EIA-RS485 Receive line (positive).
4	/TX	EIA-RS485 Transmit line (negative).
5	TX	EIA-RS485 Transmit line (positive).
6	CTNet A	CTNet data line
7	CTNet Shield	Shield connection for CTNet
8	CTNet B	CTNet data line
9	0V	0V connection for digital I/O
10	DIO	Digital input 0
11	DI1	Digital input 1
12	DO0	Digital output 0
13	DO1	Digital output 1

3.3.4 Additional I/O SM Option Module



Term	Function
1	0V common (digital)
2	Digital input/output 1
3	Digital input/output 2
4	Digital input/output 3
5	0V common (digital)
6	Digital input 4
7	Digital input 5
8	Digital input 6
9	Analog input 4
10	Analog input 5
11	0V common (analog)
12	Analog output 3
21	Relay 1
22	Relay common
23	Relay 2

3.3.5 Universal Second Encoder SM Option Module



D-Type Connector

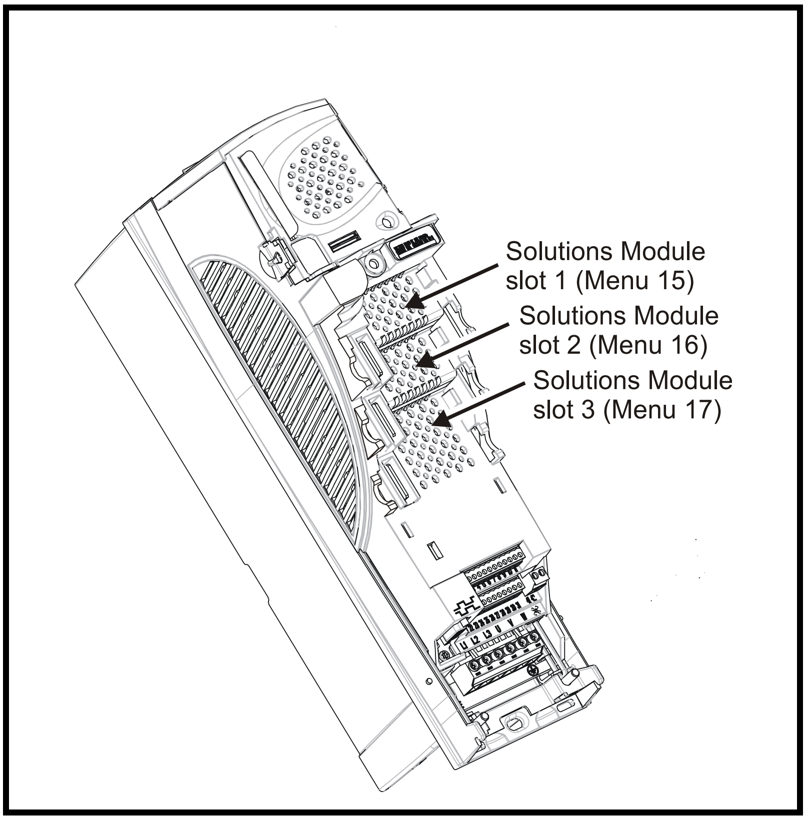
Term	Function	Description
1	Quadrature channel A input Frequency input F Forward direction input F Sin input	Encoder inputs for AB FD FR SC
2	Quadrature channel /A input Frequency input /F Forward direction input /F SinRef input	
3	Quadrature channel B input Frequency input D Reverse direction input R Cos input	
4	Quadrature channel /B input Frequency input /D Reverse direction input /R CosRef	
5	Marker pulse Z input Data bi-directional input	Encoder marker pulse input Bi-directional data transfer for Endat and SIN-COS, Unidirectional data transfer for SSI encoders.
6	Marker pulse /Z input /Data bi-directional input	
7	Commutation U input Quadrature channel A output Frequency output F Data output	Commutation input signal for servo operation Simulated encoder outputs Simulated Data output for SSI encoder
8	Commutation /U input Quadrature channel /A output Frequency output /F /Data output	

9	Commutation V input Quadrature channel B output Direction output D /Clock output	Commutation input signal for servo operation Simulated encoder outputs Simulated Clock output for SSI encoder
10	Commutation /V input Quadrature channel /B output Direction output /D Clock output	
11	Commutation W input Clock output	Commutation input signal for servo operation Clock output for SSI, Endat and SC.Endat encoders
12	Commutation /W input /Clock output	
13	Encoder Supply	Encoder supply 5V, 8V, or 15V, user selectable through parameter x.13, default = 5V.
14	0V common	
15	Th	Motor thermistor input

Terminals

Term	Function	Description
1	Freeze input	Freeze input 24V
2	0V common	
3	Frequency output F Data output	Simulated encoder output Simulated SSI Data output
4	Frequency output /F /Data output	
5	Direction output D */Clock output*	Simulated encoder output Simulated SSI Clock output
6	Direction output /D Clock output	
7	0V Common	
8	Marker output Z Freeze input	Simulated marker output Freeze input RS 485
9	Marker output /Z Freeze input	

3.3.6 Slot Menus



3.4 Analog Set points and Feedbacks

3.4.1 Specification

Analog Inputs

Specification	Unidrive-SP I/O	Optional I/O
Type of Input	1 x Differential 2 x Single-ended	Single-ended
Max. Output voltage	-10V to +10V	-10V to +10V
Input resistance	100 kohm	20 kohm
Absolute Maximum Input	± 13V with respect to 0V	± 36V with respect to 0V
Resolution	Differential = 12-bit plus sign Single-ended = 10-bit plus sign	10-bit plus sign
Update period	4ms	Dependant on the number of I/O option modules fitted: 8ms: 1xSM-I/O 16ms: 2xSM-!/O

Analog Outputs

Specification	Unidrive-SP I/O	Optional I/O
Type of output	Single-ended	Single-ended
Max. Output voltage	-10V to +10V	-10V to +10V
Load resistance	> 10 kohm	> 1 kohm
Protection	Short-circuit proof	Short-circuit proof
Resolution	10-bit plus sign	10-bit plus sign
Update period	4ms	Dependant on the number of I/O option modules fitted: 8ms: 1xSM-I/O 16ms: 2xSM-!/O

3.4.2 Analog Signal Types

UNDRIVE-SP ANALOG INPUTS

The Unidrive-SP analog inputs 2(term 7) 7 3(term 8), can accept current or voltage signals as tabulated below,. analog input 3 can be also configured for motor thermistor input, (types 7-9).

Number	Parameter Mnemonic	Signal Type
0	0 - 20	0 – 20mA
1	20 - 0	20 – 0mA
2	4-20.tr	4 – 20mA (Trip on <3mA)
3	20-4.tr	20 – 4mA (Trip on loss <3mA)
4	4-20	4 – 20mA (No trip on loss)
5	20-4	20 – 4mA (No trip on loss)
6	VOLt	+/- 10V input
7	th.SC	Motor Thermistor with trip on short circuit detection*
8	th	Motor Thermistor without short circuit detection*
9	Th.diSp	Thermistor mode with display only and no trip

The above are configured by the following parameters:

07.11 – Analog Input 2, Terminal 7

07.15 – Analog Input 3, Terminal 8

The Unidrive-SP analog outputs can derive current or voltage signals as tabulated below.

To maintain maximum flexibility no specific assignments of analog inputs are provided. Possible input signals may include Tension Set Point, dancer/tension roll feedback, diameter and line speed.

All these signals are available and can re-directed to the required analog input parameter.

UNDRIVE-SP ANALOG OUTPUTS

Number	Parameter Mnemonic	Signal Type
0	VOLt	Output range ±10V.
1	0 – 20	Output range 0 - 20 mA.
2	4 – 20	Output range 4 - 20 mA.
3	HSPd	High speed up date mode

The above are configured by the following parameters:

07.21 – Analog Output 1, Terminal 9

07.24 – Analog Output 2, Terminal 10

Again, to maintain maximum flexibility no specific assignments of analog outputs are provided. Possible output signals may include Final Tension Set Point for use with an Electronic to Pneumatic transducer to control dancer roll loading. Actual Tension as measured by a load cell or simply winder speed and torque.

All these signals are available, and can re-directed to the required analog output terminal.

OTHER INDUSTRIAL SIGNALS

To interface to the Unidrive-SP analog inputs with other industrial feedback sources, like resistive sensing PT100, Thermocouples, etc; an external signal converter or the use of Beckhoff I/O with the CTNet coupler can be used.

3.4.3 Unidrive-SP Analog I/O Allocation

In order to allow maximum flexibility when using the limited number of analog inputs no specific configuration of input function has been provided. The user should assign inputs to user's own preference to maximise the functionality of the hardware available.

Typical analog process signal allocations are tabulated below:

UNIDRIVE-SP STANDARD ANALOG I/O					
No	**Description**	**Term No.**	**I/O**	**Res.**	**Type**
AI1	Line speed reference	5&6	Input	12bit+sign	Diff
AI2	Tension Set Point or Dancer Position feedback	7	Input	10bit+sign	SE
AI3	Thermister Protection or Taper Set Point	8	Input	10bit+sign	SE
-	0v	3	-	-	-
-	+10Vdc	4	-	-	-
A01	E/P reference	9	Output	10bit+sign	SE
A02	Winder Speed (r/min)	10	Output	10bit+sign	SE
-	0v	11	-	-	-

NOTE Notes: SE – Denotes Single Ended: Diff – Denotes Differential Signal.

Where winder operation is to be totally analog, then an additional I/O module may be required.

Possible input assignments would include:

UNIDRIVE-SP ADDITONAL I/O OPTION					
No	**Description**	**Term No.**	**I/O**	**Res.**	**Type**
AI4	Load cell tension feedback	12	Input	10bit+sign	SE
AI5	Preset value for diameter setting	9	Input	10bit+sign	SE
A03	Motor Current	10	Input	10bit+sign	SE
-	0v	11	-	-	-

3.4.4 Unidrive-SP Analog I/O Configuration

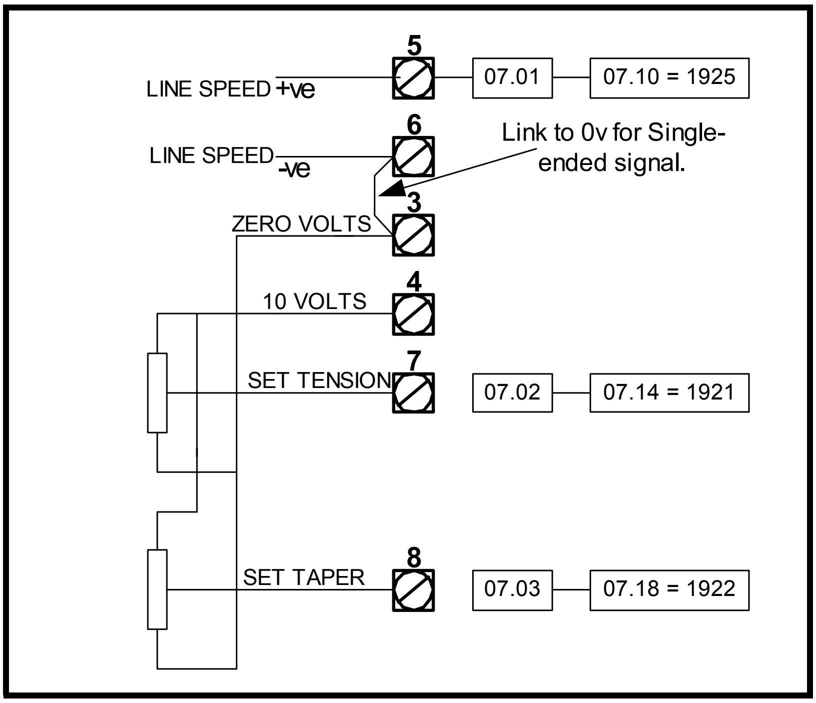
UNIDRIVE-SP STANDARD ANALOG I/O						
	Specification				Parameters	
Term No.	I/O	Res.	Type	Mode	Scale	Dest./ Source
5 & 6	Input	12bit+sign	Diff	Volts	07.08	07.10
7	Input	10bit+sign	SE	07.11	07.12	07.14
8	Input	10bit+sign	SE	07.15	07.16	07.18
3	0V	-	-	-	-	-
4	+10V	-	-	-	-	-
9	Output	10bit+sign	SE	07.21	07.20	07.19
10	Ouput	10bit+sign	SE	07.24	07.23	07.22
11	0V	-	-	-	-	-

NOTE SE – Denotes Single Ended: Diff – Denotes Differential Signal.

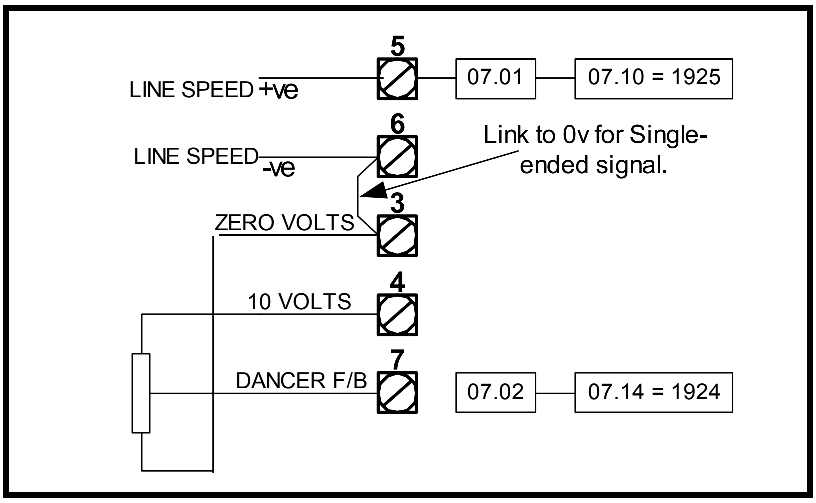
All standard Unidrive-SP analog inputs and outputs can be configured for voltage (+/-10V) or current signals (0/4-20mA) modes. The additional I/O is only configured for voltage (+/-10Vdc)

3.4.5 Typical Analog Set-point & Feedback Connection Diagram

Example 1 (Referencing for Analog Torque Winder)



Example 2 (Referencing for Analog Speed Winder)



3.5 Digital I/O

3.5.1 Specification

Digital Input/Outputs

Specification	Unidrive-SP I/O	Optional I/O
Type of Input/output	Positive or negative logic digital inputs or negative logic push-pull or open collector outputs. Complies with IEC1131(positive logic only).	Positive or negative logic digital inputs or positive logic only digital outputs. Complies with IEC1131(positive logic only).
Voltage range	- 0V to +24V	- 0V to +24V
Absolute max. Voltage range	-3V to +30V	-3V to +30V
Input current @ +24V	>2mA @ 15Vdc	>2mA @ 15Vdc
Output current	200mA	250mA
Overload	240mA	500mA
Update period	4ms	Dependant on the number of I/O option modules fitted: 8ms: 1xSM-I/O 16ms: 2xSM-I/O

Digital Inputs

Specification	Unidrive-SP I/O	Optional I/O
Type of Input	*Negative or Positive logic	*Negative logic
Voltage range	- 0V to +24V	- 0V to +24V
Absolute max. Voltage range	-15V to +30V	-15V to +30V
Input current @ +24V	>2mA @ 15Vdc	>2mA @ 15Vdc
Update period	4ms	Dependant on the number of I/O option modules fitted: 8ms: 1xSM-I/O 16ms: 2xSM-I/O

Relay Outputs

Specification	Unidrive-SP I/O	Optional I/O
Contact Voltage Rating	240Vac, insulation cat.2	250Vac
Max Current	5A Resistive	1A Resistive
Contact minimum recommended rating	12V 100mA	12V 100mA
Update period	4mS	Dependant on the number of I/O option modules fitted: 8ms: 1xSM-I/O 16ms: 2xSM-I/O

3.5.2 Polarity of Logic and I/O Address Parameters

The logic polarity can be configured for 'Positive Logic (Sink)' or 'Negative Logic (Source), where 24Vdc supply can be sourced locally from the Unidrive-SP (Terminal 22) or from an external power supply.

Positive Logic Select Parameters:

Unidrive-SP Standard Digital I/O = 08.29

Unidrive-SP Optional Digital I/O = ##.29

Unidrive-SP

UNIDRIVE-SP STANDARD DIGITAL I/O					
Specification				Parameters	
Term No.	I/O	Ind	Output Select	Invert	Dest./ Source
41& 42	Relay	08.07	-	08.17	08.27
22	24Vdc	-	-	-	-
23	0Vdc	-	-	-	-
24	I/O	08.01	08.31	08.11	08.21
25	I/O	08.02	08.32	08.12	08.22
26	I/O	08.03	08.33	08.13	08.23
27	Input	08.04	-	08.14	08.24
28	Input	08.05	-	08.15	08.25
29	Input	08.06	-	08.16	08.26
30	Input	08.08	-	-	Enable
31	0v	-	-	-	-

SM Additional I/O

UNIDRIVE-SP STANDARD DIGITAL I/O					
Specification				Parameters	
Term No.	I/O	Ind	Output Select	Invert	Dest./ Source
1	0V (digital)	08.07	-	-	-
2	I/O	##.09	##.31	##.11	##.21
3	I/O	##.10	##.32	##.12	##.22
4	I/O	##.03	##.33	##.13	##.23
5	0V	-	-	-	-
6	input	##.04		##.14	##.24
7	input	##.05		##.15	##.25
8	input	##.06		##.16	##.26
21	Relay 1	##.07		##.17	##.27
22	Relay com	-	-	-	-
23	Relay 2	##.08		##.18	##.28

NOTE ##. Denotes the menu corresponding to the slot number where the SM option module is fitted. Refer to section *Slot Menus* on page 17 for more details.

3.5.3 Unidrive-SP Digital I/O Allocation

As in the case of the analog I/O assignment no specific configuration has been provided. This leaves the user with maximum flexibility to define his own I/O mappings from local Terminal I/O or Remote via Fieldbus communications.

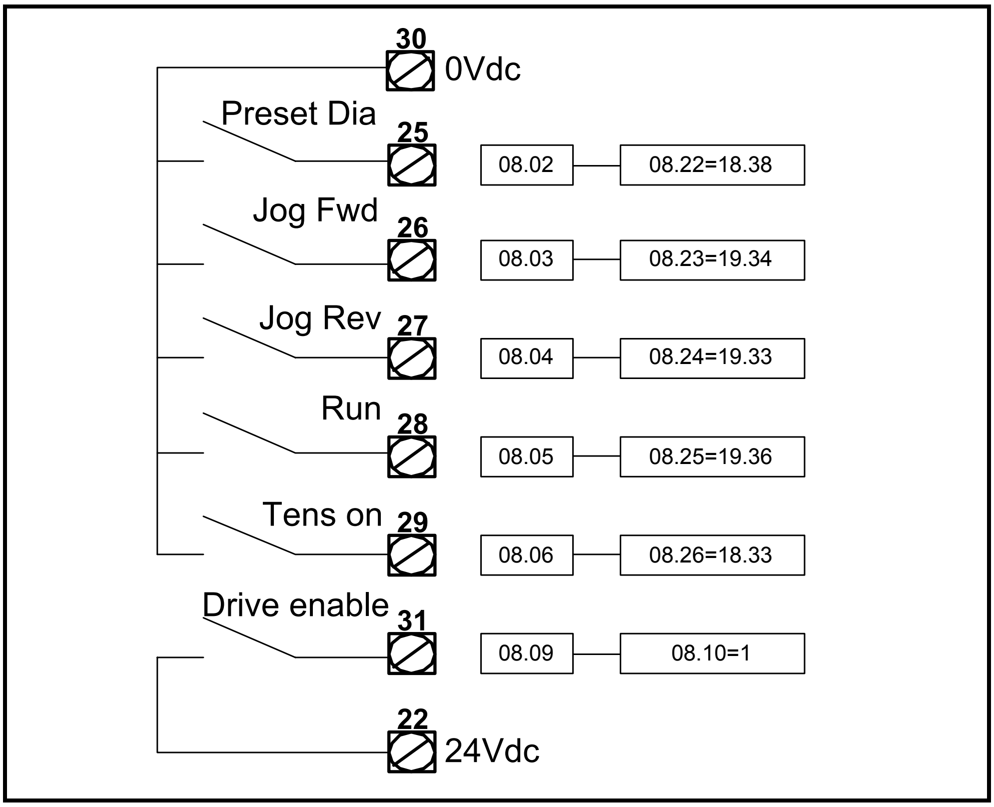
A basic system may be set up as listed below:

Unidrive-SP STANDARD I/O			
No	Description	Terminal	I/O
F1	Zero speed	24	Output
F2	Preset diameter	25	Input
F3	Jog forward	26	Input
F4	Jog reverse	27	Input
F5	Line Running	28	Input
F6	Tension On	29	Input
F7	Drive enable	31	Input
F8	Drive OK	1 & 2	Relay Output
-	+24Vdc, 200mA Supply total (including digital outputs)	22	-
-	0v Supply	23 & 30	-

NOTE Fitting an SM-I/O module will provide additional I/O.

3.5.4 Typical Digital I/O Connection Diagram

Example 1 (Digital I/O for basic Speed or Torque Winder)



3.6 Winder Drive Configurations

When Unidrive-SP is used for Winder Applications it should be operated only in closed loop mode.

Depending upon the powers required either a standard induction motor or servo motor might be used.

In either case the motor must be fitted with a position feedback device, this may be an incremental or SinCos encoder or a Resolver. When a Resolver is used then the requisite SM option module must be fitted which will restrict the number of I/O expansion module that can be fitted to one.

No additional module is required when an encoder is used (e.g. Incremental, SSI, SinCos). For systems having wide speed ranges resulting in operation at low speeds it may be advisable to use an encoder with an increased PPR value or SinCos encoder.

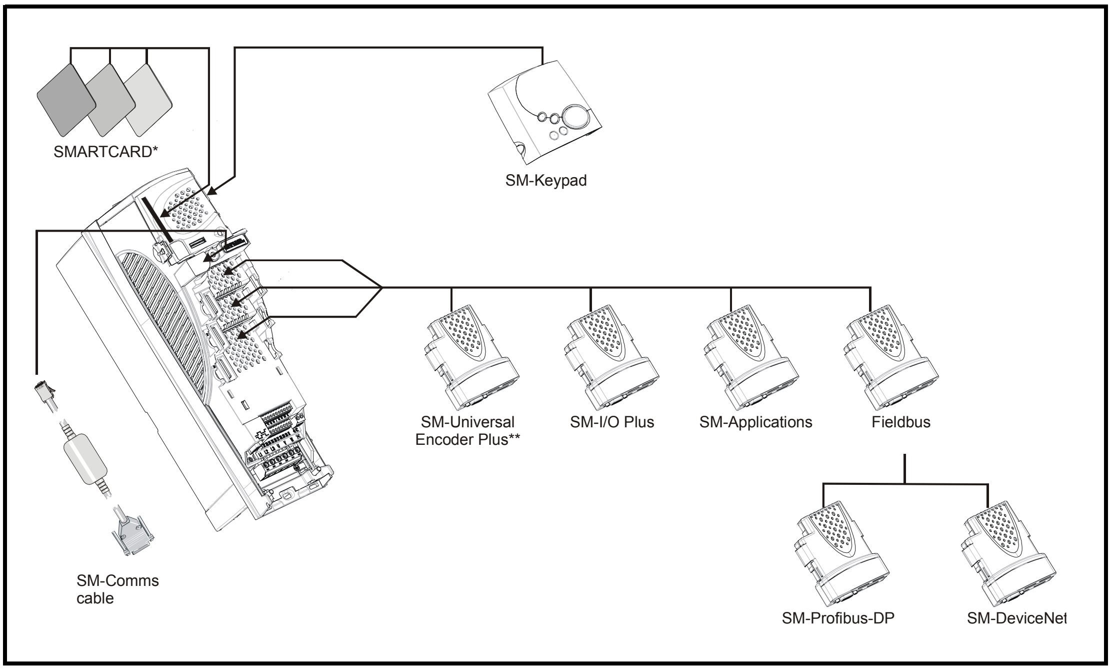
When a Servo motor is to be used then it is not possible to operate above the rated base speed of the motor and the motor should be selected using the criteria applied to constant torque motor sizing.

If the winder is to follow a line speed reference provided by an encoder then a suitable small option module must be fitted. The system is arranged to operate with any of the following options:

SM-Universal Encoder Plus module

SM-Encoder Plus module

SM-Resolver module


SMARTCARD*
SM-Keypad
SM-Universal
Encoder Plus**
SM-I/O Plus
SM-Applications
Fieldbus
SM-Comms
cable
SM-Profibus-DP
SM-DeviceNet

4 Software Installation

There are two software files that must be installed within the Application module, these are as follows:

Application file - SPWINDER.bin

System file - SMAPPS.sys

NOTE: The files above are selected for download from the list of files within the Solution .WFS file, downloaded using Control Techniques Windows^{TM} 'WinFlasher'. The user does not have direct access to the .bin or .sys file.

Depending on which slot the SM-Application module is fitted, (Refer to section *Slot Menus* on page 17 for further details regarding the slot menu); the following parameters indicate the installed software version. '0' denotes no software file is installed.

Parameter	Description	Parameter Notation
##.02	System file version number	2.81 = V02.81.xx
##.51	System file sub-version number	12 = Vxx.xx.12
20.39	Application file version number	20801 = V02.08.01

To download the system and/or the application file to the application module the following is required:

Hardware – Communications Connection

Communications between the PC and Unidrive-SP can either be RS485 or CTNet (SM-Applications only):

Unidrive-SP RS485 Port

For this the CT RS232 to RS485 converter lead is required. The RS232 D-type connects to PC and the RJ45 connects the Unidrive-SP RS485 port. The following parameters are to be set to ensure successful communications:

Parameter	Description	Value
11.23	Node address	1
11.24	Serial Mode	rtu
11.25	Baud Rate	19200

CTNet

Refer to the SM-Application module manual for connection and Parameter details.

Software

To download the file Control Techniques Windows^{TM} 'WinFlasher' software utility is required. This software is available on the CD, from any Control Techniques drive centre, or comes complete with 'Sypt' programming tool.

4.1 CTIU Software

When the CTIU110 is used, the following software file is required to be downloaded to the unit.

- AC SP Winder metric.cmc or AC SP Winder imperial.cmc
  Refer to section *Software Version* on page 147 for more details.

The software can be downloaded using Control Techniques Winflasher or the CTIU programming tool.

The serial communication lead should be connected between the PC serial port and the RS232 port (9way D-type), on the CTIU.

5 Getting Started

5.1 Unidrive-SP

1. Refer to the Unidrive-SP Getting Started Manual, for CLOSED LOOP VECTOR or SERVO mode, to commission the Unidrive-SP before attempting to set up the Winder Application.

NOTE For Unidrive-SP Closed Loop Vector mode, the motor map must be correctly set for this software to work correctly. Ideally the power factor should be set by performing an autotune with the motor unloaded. DONOT rely on the Motor nameplate power factor.

2. It may also be necessary to configure all or some of the related parameters that are listed in section 5.1 in the Main User manual.
3. The following parameters are directly controlled from the winder application software and will not require setting:

Parameter	Description	Software setting
01.06	Max Speed	-
01.07	Min Speed	0
01.10	Bipolar Reference Enable	1
01.14	Reference Selector	3
01.15	Preset Selector	1
01.21	Preset Speed Reference 1	-
02.02	Ramps Enable	-
04.08	Torque Reference	-
04.09	Torque Offset	-
04.11	Torque mode selector	-
06.04	Sequencer mode	4
06.15	Software Inhibit	-
06.30	Sequence Bit 1 (run forward)	-
06.31	Sequence Bit 2 (jog)	0
06.32	Sequence Bit 3 (direction)	0
06.40	Enable sequencer latching	0

\- Denotes variable setting dependant on mode and control state of winder software.

4. Depending on the slot the SM-Applications module is fitted, ensure parameter ##.13 = 1. (Refer to section *Slot Menus* on page 17 for further details regarding the slot menu) This enables the Winder software to auto-run on power up. If not set perform the following procedure:
   i. Set parameter ##.13 =1
   ii. Set parameter 00.00 = 1000 and press the reset. This will save all current settings of parameters in menus 1 to 19 to non-volatile memory.
5. Set parameter 00.00 = 1070 and press the reset. This will reboot the application module and run installed application software.

5.2 Winder Control

1. Ensure that the Unidrive-SP is switched off and insert the Application Module and any additional SM option modules, which are necessary to complete the configuration (refer to section *Fitting of Option Modules* on page 9 for more details).
2. Before attempting to power up the Unidrive-SP ensure that Enable input terminal 31 is open circuit.
3. If the software has not been installed then switch on and follow the instructions under *Software Installation* on page 28.
4. The range of options possible with this package i.e. Control using only the basic Unidrive-SP I/O, enhanced control using the Additional I/O module or serial control from an operator's terminal or PLC, allows only a general approach to the application configuration outlined here. Internal process input and control parameters have been assigned for every function but the actual input configurations have been left completely open allowing the user to configure exactly the combination of analog, digital and serial control required to suit his application.
5. When Speed Mode is used ensure that a dancer roll feedback device is available. Where a potentiometer is used as the dancer position transducer then it is recommended that a 360degree plastic track potentiometer be used. The dancer mechanism should be arranged with end stops to prevent over travel of the potentiometer. Dancer mechanisms should be designed with minimal inertia and friction, movement should be as free as possible with no tight spots.
6. When a load cell is used for direct tension measurement then it should be calibrated. Procedures for calibration are usually provided in the load cell installation guide. Normally calibration procedures require the use of suitable weights and ropes.
   Establish the correct material path over the rolls to determine how to thread the rope and apply the simulated tension loading. Remember that 1kilogram is approximately 10 Newtons.
7. User parameters have been assigned to all control functions ensuring maximum flexibility when configuring the system. Control for simpler systems may be provided using only the basic Unidrive-SP analog and digital I/O. More complex systems may require the addition of an I/O expansion module. When a Sin-Cos encoder or Resolver small option module is fitted as the main feedback, it may be necessary to access some or all of the control parameters using serial communications either directly from an operator terminal or from a PLC.

5.3 Operating Procedures

5.3.1 General Requirements

This software has been provided with the following set point and control inputs:

Process related

1. Line speed in analog or serial formats

   Analog referencing allows the input to be provided by a 0 – 10 Volt signal or from an encoder (suitable small option module required).
2. A line speed reference must be provided. It should be sourced either from the master drive or from the last drive preceding the winder.
3. The line speed reference must be ramped, for more critical applications this should be an S Ramp.
4. Line acceleration rate in serial format.

Operator related

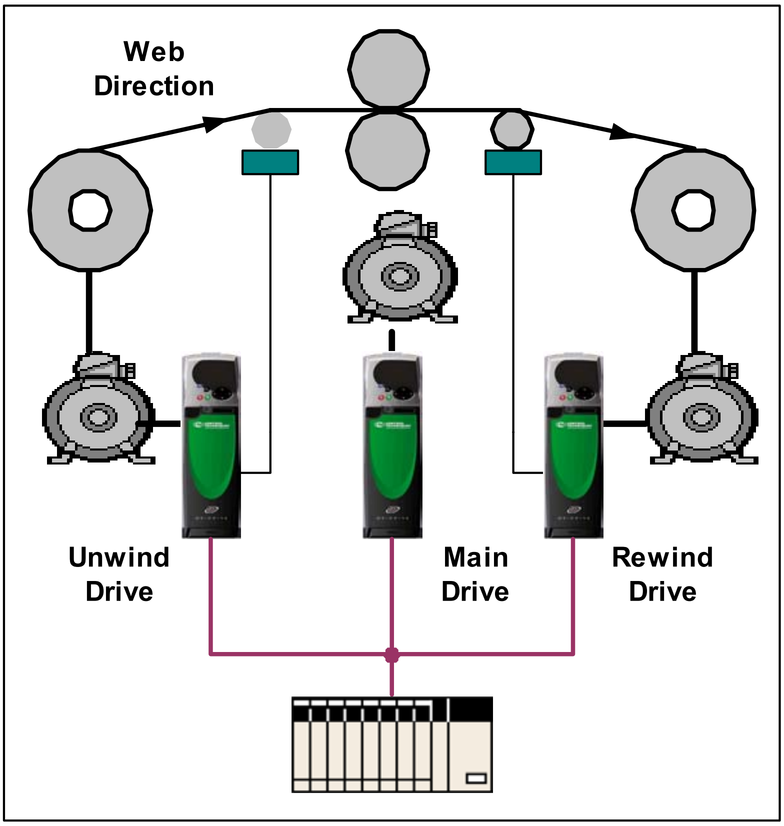
5. Set point values
   - Tension set point in analog or digital format
   - Taper set point in analog or digital format
   - Diameter set point in analog or digital format
6. Control inputs
   - Pay Out and Take Up jog commands
   - Tension On / Off command
   - Line Run command
   - Preset diameter command
   - Over/Under wind direction selection (reverses the direction of rotation)

5.3.2 Direction of Rotation

In order to ensure correct operation of the software and achieve the required direction of rotation of the winder the following conventions must be followed.

All rotations are defined as looking on the front side of the winder (opposite side to the motor) and on the shaft end of the motor. If the installation employs either a direct drive or a belt drive both motor and winder directions of rotation will be identical.

Default is considered as clockwise when following a positive line speed reference signal transporting material from an Unwind to a Rewind with no gear box reversals, as shown below:



Set up to achieve the required directions of rotation is summarised in the tables below.

Positive line speed reference:

No reversal between motor and winder.

Winder rotn	18.36	Motor rotn	19.41
CW	0	CW	0
CCW	1	CCW	1

Reversal between motor and winder due to gearbox

Winder rotn	18.36	Motor rotn	19.41
CW	1	CCW	1
CCW	0	CW	0

If a drive is selected as an Unwind the settings above still apply with the addition of the Unwind selection bit 18.39 which should be set.

Parameter 18.36 is used to achieve the correct rotation of the winder shaft and 19.41 is used to set up the lap count direction to suit the direction of motor rotation and use as Rewind or Unwind.

Reversing applications may be achieved simply by reversing the polarity of the line speed reference signal. Under this reverse condition no changes to the configuration will be required.

5.3.3 Operational Functions

Normal operation would involve threading the machine using the Pay Out and Take Up (Jog Fwd & Rev) controls to wind the material around the mandrel or unwind it from the unwind roll. On simpler machines this function may be carried out by rotating the winder manually making the pay out and take up functions unnecessary.

Before attempting to engage tension control the software must be provided with the correct value of diameter for the incoming roll or mandrel using the diameter preset function. Presetting may only be carried out when the drive is not selected to tension.

Once the material has been made good through the machine the system can be switched to tension control by energising the Tension On command. Tension control will be maintained whilst this command bit remains set.

If the winder is to be used in Torque mode then the operator should ensure that there is minimal slack at the winder otherwise a rapid take up may occur when Tension On is selected. In Speed mode any slack will be taken up smoothly when Tension On is selected.

Upon selecting tension control, in Torque Mode the correct tension producing torque will be applied and the winder should hold the material tight in stalled tension. When starting of the main drive is signalled by the run command the tension will be increased to the value determined by the tension set point. If a load cell is provided then PID control in torque mode should normally be enabled once the main drive has started. And removed when the machine is at standstill.

In Speed Mode the winder will go into the Dancer centreing routine and will rotate to adjust the material tension until the dancer moves in to the target area. At this point the PID control will be enabled and the winder will remain under tension at standstill until the main drive is started. The PID will remain enabled until the tension on command is removed. If load cell feedback is selected then the dancer centreing routine will be bypassed.

Suggested minimum features for external sequencing control:

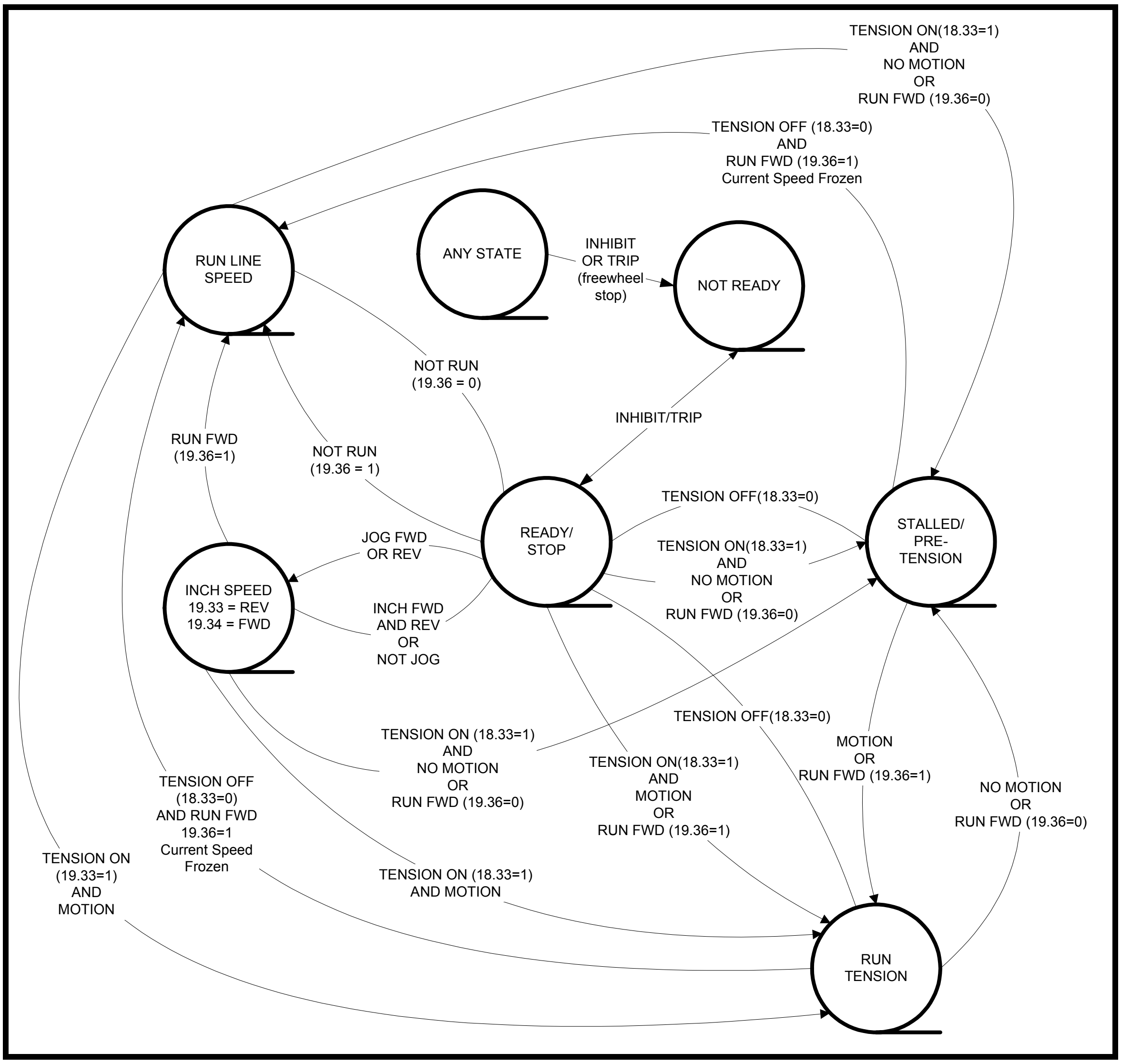
1. It should not be possible to energise the jog commands while tension on is selected.
2. Diameter presetting can only be performed when the tension on is not set.
3. The diameter must be preset before the start of a new unwind roll or rewind mandrel.
4. It should not be possible to select the main drive to the run condition until the winder has been set to tension on. It may be necessary for the main drive to jog whilst threading the machine.
5. Once selected it should not normally be necessary to remove the tension on command whilst the material remains intack until the roll has been completely

wound and the machine is at standstill. During odd stoppages for process reasons the tension will be reduced to the stalled tension value.

6. Should it be necessary to remove or part the material during the course of the process then the tension on command should be disabled.
7. If a web break occurs or some other emergency condition arises, removing the Tension on command will revert the drive to speed control and it will continue to run at the speed registered at that moment. If the run command is then removed the drive will ramp down to zero speed, (stopping mode is dependant on the setting of parameter 06.01, this is preferred to be set to ramped mode 'rp'). Arrangements should be provided to allow such a controlled stop to take place before the drive is inhibited.

State Engine for Winder Control

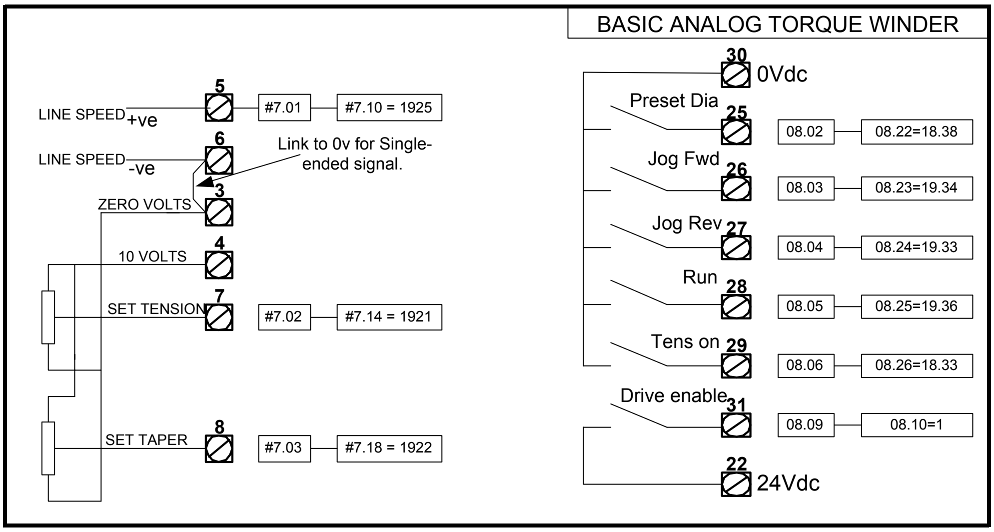
The following diagram indicates the allowable transitions in control state permissible when using the winder software.



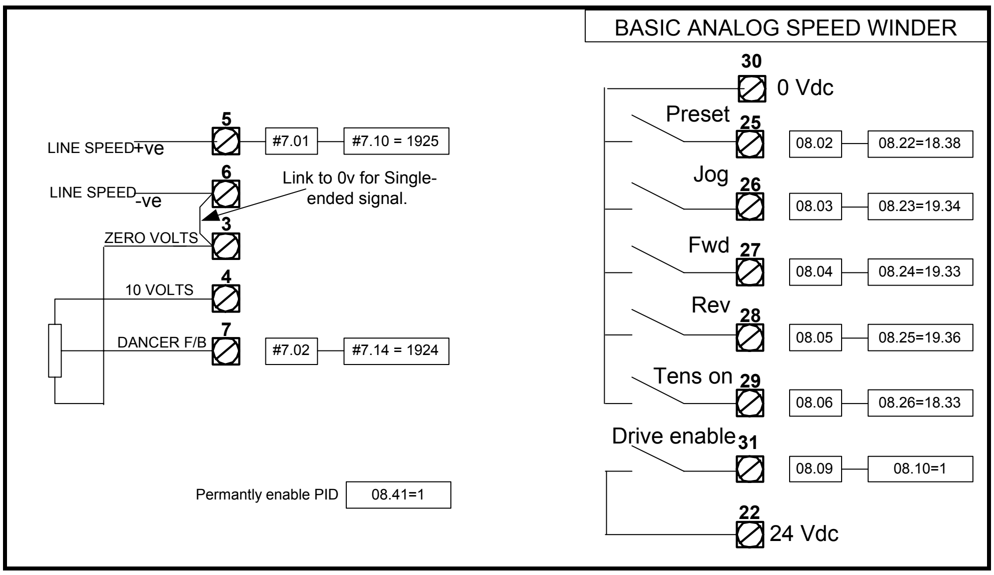
5.4 Basic I/O Configurations

These diagrams show the minimal configuration required for Winder operation. Any additional features may be provided either by the addition of an extended I/O module or via serial communication from a PLC or MMI.

5.4.1 Basic configuration for a Torque controlled winder

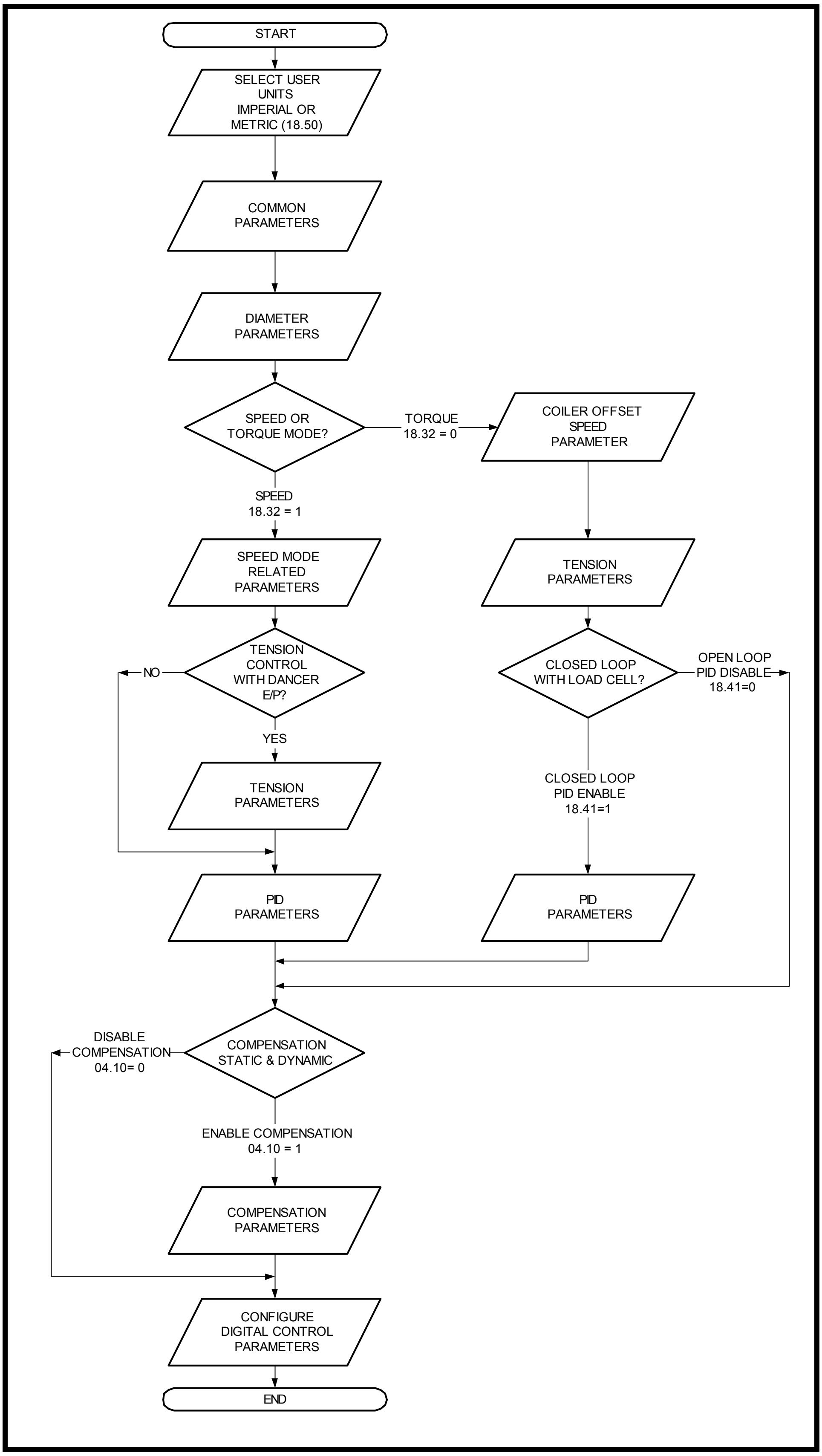


5.4.2 Basic configuration for a Speed controlled winder



5.5 Configuration of Parameters

The flow chart below indicates the suggested sequence parameter for set up.



5.5.1 Classified Parameter Listing

The following parameters list is grouped to match the approach suggested in the preceding diagram.

Common Configuration Parameters

No.	Description	Units	Comments
18.50	**Select the form of engineering units for set up data**	Bit	0 – Metric 1 – US Standard LOCKED WHILE RUNNING
18.36	**Select Over or Under winding direction**	Bit	0 – Over wind 1 – Under wind Reverses the direction of rotation. Set this bit if the web is entry or exit from the coil needs to be changed, or the direction is reversed due the gearbox or orientation of the motor. LOCKED WHILE RUNNING
18.39	**Select to operate as an Unwind**	Bit	Winder control for the forward line speed direction. 0 = Rewind. 1 = Unwind. LOCKED WHILE RUNNING
18.29	**Maximum line speed**	m/min *(ft/min)*	Set to the maximum line speed. For variable maximum line speed for different product this could be updated remotely via serial comms.
19.30	**Line Speed Slip factor**	0.001%	Set the slip factor to compensate for any difference between nip speed and line material speed at the master drive. e.g. 1000 = 1.000%
19.31	**Select serial input for Line Speed reference**	Bit	0 – Analog Line speed reference. Refer also to parameter 19.25. The acceleration is derived from this signal internally by the software. 1 – Line speed and acceleration are derived via serial communications to parameter 73.01 & 73.02 respectively.
19.25	**Line Speed reference Analog format**	PU	Source an analog input to this parameter, preferably analog 1. Refer to section 3.4.4. Ensure it is positive with required forward line direction.
18.23	**Gear ratio**	0.01	Enter gear ratio e.g. 250 = 2.5. Set to 100 when no gearbox is used.
18.18	**Material gauge**	μm *(0.001ins)*	Enter Material gauge, this is used for lap count and Inertia compensation calculation.
18.21	**Motor base Speed**	r/min	Motor nameplate speed at mains frequency.
18.22	**Motor base Power**	0.1kW (*0.1hp*)	Motor Nameplate Power at base speed.
19.14	**Thread/Inch speed**	m/min *(ft/min)*	Pay Out and Take Up, Inch speed reference.
20.28	**Watch dog enable**	Bit	Enable when winder is controlled remotely via serial communication. Refer to parameter descriptions for more details.
19.50	**Enable Speed Boost**	Bit	Adds the value in 20.26 to the line speed reference
20.20	**Watchdog Clock Time**	0.01s	
20.21	**Watchdog trip delay**	0.1s	
20.26	**Speed Boost value**	MPM	Amount by which the line speed ref will be increased when 19.50 = 1
20.27	**Select encoder as line speed reference source**	Bit	Allows the winder to follow an up stream encoder
20.29	**Time base for line encoder speed measurement**	0.01s	

20.30	**Line encoder RPM at maximum line speed**	RPM	Scales encoder frequency to maximum line speed
	Status & Indication Parameters		
19.04	**Final Speed Reference**	0.1m/min *(0.1ft/min)*	Winder final line speed reference
18.04	**Line Speed**	0.1m/min *(0.1ft/min)*	Line speed from master drive
18.05	**Winder Speed**	r/min	Actual Winder speed
18.06	**Motor Speed**	r/min	Actual Motor speed
18.46	**Web break error flag**	Bit	0 – OK 1 – Web break (Latched & Reset when drive is stopped)
18.49	**Watch dog trip**	Bit	0 – OK 1 – Trip
19.46	**Speed reference polarity**	Bit	0 – Positive (Forward line direction) 1 – Negative (Reverse line direction)

Diameter Parameters

No.	Description	Units	Comments
18.16	**Minimum diameter**	mm *(0.1ins)*	Core diameter
18.17	**Maximum diameter**	mm *(0.1ins)*	Coil max diameter
18.35	**Select direct measurement of diameter via analog input**	Bit	0 – Diameter is calculated internally 1 – Direct Analog measurement of diameter Refer also to parameter 19.23
19.23	**Preset Diameter Analog format**	PU	Source an analog input to this parameter. Refer to section 3.4.4. Ensure the signal is positive and increases with diameter
70.57	**Analog diameter signal min. value**	PU	Set to the value in 19.23 for minimum diameter.
70.58	**Analog diameter signal max. value**	PU	Set to the value in 19.23 for maximum diameter.
19.40	**Select Diameter Set Point from parameter 19.11/ 19.12**	Bit	Preset diameter reference 0 – From analog signal derived via 19.23 1 – From parameter 19.11/19.12
19.35	**Select second diameter preset parameter 19.12**	Bit	19.35 = 0 Preset from 19.11 19.35 = 1 Preset from 19.12
19.11	**Preset diameter value 1**	mm *(0.1ins)*	Set to Preset diameter when 19.40 = 1 & 19.35 = 0. This preset diameter is only entered when tension is off, 18.33 = 0, and parameter #18.38 = 1. Refer to current diameter parameter 18.01 when #18.38 =1 has been performed
19.12	**Preset diameter value 2**	mm *(0.1ins)*	Set to Preset diameter when 19.40 = 1 & 19.35 = 1. This preset diameter is only entered when tension is off, 18.33 = 0, and parameter #18.38 = 1. Refer to current diameter parameter 18.01 when #18.38 =1 has been performed
18.38	**Preset diameter command bit**	Bit	Set to enter preset diameter, refer to 19.11 and 19.12. The bit will auto reset to 0.
18.44	**Diameter Calculation Mode**	Bit	0 – Ratio mode ((m/min) / (r/min)) 1 – Lap count mode. Refer to parameter 19.43

19.41	*LAP* **Reverse direction of diameter change under Lap or Traverse**	Bit	Reverses the direction of the lap counter. Use to correct diameter change direction when reversal occurs due to winder configuration. When the unwind, (18.39) & under/over lap, (18.36) parameters have been correctly configured, set lap count reversal bit if the diameter is inc/dec in the wrong direction.
19.43	*LAP* **Select Traverse mode for diameter calculation**	Bit	Traverse winding 0 – Diameter Lap count determined by the number of winder revolutions multiplied by 2xGauge. 1 – Diameter Lap count is incremented by 2xGauge every reversal of the traverse axis. Refer to parameter 19.42.
19.42	*LAP* **Signal Traverse reversal**	Bit	Source a digital input to this parameter for the traverse reversal pulse signal.
19.37	*RATIO* **Hold diameter command bit**	Bit	Set this bit to freeze the current diameter value. This can be sourced from a digital input.
18.11	*RATIO* **Diameter Hold function speed threshold**	r/min	Set this to the low speed threshold where the speed indication becomes too erratic for the speed calculation.
19.32	*RATIO* **Select fixed diameter slew limit**	Bit	0 –Slew rate determined from material gauge and the winder speed. 1- Fixed slew from parameter 19.13. Diameter slew rate clamps the rate of change out put by the diameter calculator, effectively filtering transient excursions.
19.13	*RATIO* **Fixed value for Diameter slew rate**	μm/s *(0.001ins/s)*	If 19.13 =1 then set the slew accordingly.
20.36	**Slew Rate Hold Threshold**	μm/s *(0.001ins/s)*	If the slew rate falls below this level the diameter hold function will become active. Application specific.
20.22	**Winder Speed Sample Time**	ms	Set this parameter to ensure a smooth indication of winder speed for the ratio diameter calculation. Too short a sample time will produce erratic diameter results & to slow will effect the performance of the winder.
20.33	**Acquire multiplier**	-	Set to provide the required increase in slew rate for the application.
20.34	**Enable acquire on start**	Bit	Applies the acquire multiplier (20.33) on start up.
20.35	**Enable acquire**	Bit	Applies the acquire multiplier (20.33) when set.
20.31	**Enable Slack Web detection**	Bit	Set to hold the diameter calculation, when a slack web is detected.
20.32	**Slack Web detection threshold**	0.1%	Sets the sensitivity for detecting a slack web.
	Status & Indication Parameters		
18.01	**Current Diameter display**	mm *(0.1ins)*	Current actual diameter
18.09	**Diameter Hold Flag**	Bit	Indicates diameter Hold active.
18.02	**Preset diameter value**	mm *(0.1ins)*	Current cache preset diameter value
18.45	**Diameter calculation error flag**	Bit	0 – OK 1 - Error

Speed Mode Parameters

No.	Description	Units	Comments
18.32	**Speed Mode select**	Bit	Set for Speed controlled winder 0 – Torque mode 1 – Speed mode
18.31	**Select Dancer or Load cell operation**	Bit	Set for the required feedback 0 – Dancer 1 – Load cell
19.24	**Load cell/Dancer feedback**	PU	Source an analog input to this parameter. Refer to section 3.4.4. Ensure the signal is positive and increases with dancer position.
19.20	**Dancer Position Set point**	PU	Manual set the dancer arm to the required position. Take reading from dancer feedback parameter 19.24 and set this parameter to the same value.
18.24	**Centreing Window**	PU	This will determine the window of acceptance, for the completion on the centreing routine. If set too low with a high centreing speed (19.29) or low accelerations (19.28), could cause oscillations as the winder cannot stop within the set window.
19.29	**Centreing Speed**	m/min *(ft/min)*	Set centreing speed, refer to 18.24 for more details
19.28	**Centreing Acceleration**	cm/min/s *(ins/min/s)*	Set centreing acceleration rate, refer to 18.24 for more details
19.47	**Select Torque memory mode**	Bit	0 = Normal speed mode 1 = Fix torque at previous average value
20.40	**Coupling Speed**	r/min	This is the set speed when coupling is enabled (19.44=1). Set in winder r/min, for alignment of coupling.
70.41	**Coupling Current limit**	0.1%	This is the set current limit when coupling is enabled (19.44=1).
	Status & Indication Parameters		
18.03	**Required tension as per unit value use for E/P output**	PU	Source to analog output for Dancer E/P tension setpoint.
18.47	**Web Tensioned Flag**	Bit	0 – Not tensioned 1 – Tensioned, centreing routine complete

Torque Mode Parameters

No.	Description	Units	Comments
18.32	**Speed Mode select**	Bit	Set to 0 for torque controlled winder 0 – Torque mode 1 – Speed mode
18.12	**Offset speed**	m/min *(ft/min)*	Set this offset to ensure the drive remains in torque control and tension is maintained at all speeds whether it is unwinding or rewinding.
	Status & Indication Parameters		
18.07	**Actual Tension**	N *(lbf)*	Actual winder Tension
18.08	**Tension Set point**	N *(lbf)*	Winder Tension set point, derived after the taper has been applied and tension ramped.
19.01	**Tension torque component**	Nm *(lb.ft)*	Related to the real tension, without compensation.

Tension Parameters

No.	Description	Units	Comments
18.30	**Maximum Tension**	N *(lbf)*	Enter maximum tension range, used for internal scaling. This should be matched to the load cell or the E/P range of the dancer and the size of the motor.
18.13	**Percentage of Tension applied as Stall Tension**	%	Set the required percentage tension at standstill. This percentage could be of set point or Max Tension depending on setting of parameter 18.34.
18.34	**Set stall tension as percentage of Maximum tension**	Bit	Stall percentage range of 0 – Set point 1 – Maximum Tension 18.30
18.37	**Select condition which switches from Stall to Run tension**	Bit	Select run tension using 0 – Run input true 1 – Line speed reference above zero
19.38	**Select Tension Set Point from parameter 19.26**	Bit	Tension Reference selection 0 – analog parameter 19.21 1 – Digital parameter 19.26
19.21	**Tension reference Analog format**	PU	Source an analog input to this parameter. Refer to section 3.4.4. Ensure the signal is positive and increases with Tension demand.
19.26	**Tension Set point (Digital)**	N *(lbf)*	Tension reference when 19.38 = 1. Entered in Newtons
19.18	**Tension reference ramp time**	s	Enter ramp time dependant on the application.
18.40	**Hyperbolic Taper select**	Bit	Taper profile type selection 0 – Linear 1 - Hyperbolic
19.39	**Select Taper set Point from parameter 19.27**	Bit	Taper set point selection 0 – analog parameter 19.22 1 – digital parameter 19.27
19.22	**Taper reference Analog format**	PU	Source an analog input to this parameter. Refer to section 3.4.4. Ensure the signal is positive and increases with Taper percentage.
19.27	**Taper Set point (Digital)**	%	Enter Taper set point at maximum diameter when 19.39=1.
19.17	**Diameter at which Taper Tension will start**	mm *(0.1ins)*	Set the diameter threshold when the taper tension profile will start.
19.48	**Enable Lay On Roll tension boost**	Bit	Increases the tension by the percentage of max tension in 20.25
19.49	**Enable Indexing tension boost**	Bit	Increases the tension by the percentage or running tension in 20.24
20.24	**Index tension boost value as a percentage of operating tension**	0–1000 = 0–100%	Sets the extra torque applied to compensate for turret indexing
20.25	**Lay On boost value as a percentage of maximum tension**	0–1000 = 0–100%	Sets the extra torque applied to compensate for the effect of the Lay On roll during roll changes
	Status & Indication Parameters		

NOTE Tension set point is used in SPEED mode, for setting the required Dancer Tension set point via an E/P analog signal.

PID Parameters

No.	Description	Units	Comments
19.24	**Load cell / Dancer feedback**	PU	Source an analog input to this parameter. Refer to section 3.4.4. Ensure the signal is positive and increases with Tension or position.
18.14	**PID control P gain**	0.001Kp	Proportion Gain. For an error of 1, and a Proportional gain of 1000, the output of the P term will be 1.
18.15	**PID control I gain**	0.1Ki	Integral gain For a constant error of 1, and an Integral gain of 10, the output of the Iterm will reach 1 after 1 second.
18.19	**PID D Gain**	0.1Kd	Derivative Gain For a constant rate of change of error of 1 unit per second and a differential gain of 10, the output of the D term will be 1.
18.25	**D Filter**	-	Derivative 2nd order filter. This will filter fast rates of rise of the derivative term.
18.20	**Limit on PID output**	Tension-% Speed-cm/min (0.01ft/min)	This sets the amount of action range from the PID to the main feed forward reference. Speed – Trim to the main speed reference. Torque – ratio of the main tension reference
18.41	**PID Enable**	Bit	0 – Disable PID 1 – Enable PID. Initiates centreing and enables PID when centreing completed in Speed Mode. Enables PID directly in Torque Mode.
18.42	**PID Hold integral**	Bit	0 – Normal integration 1- PID Hold integrator
18.43	**PID Reset integral**	Bit	0 – Normal integration 1- Reset Integrator.
	Status & Indication Parameters		
19.03	**PID error**	Torque - PU Speed - pos	Error = set point - feedback
19.06	**PID Output**	Torque – 0.1% Speed – cm/min (0.01ft/min)	PID output result.
20.37	**Start value for PID gain profiler**	Percent of Max MPM	Sets the speed above which the PID gain in Speed Mode will be increased in proportion to line speed

Compensation Parameters

No.	Description	Units	Comments
	Compensation Enable ***(Torque Offset enable)***	Bit	Set to enable loss and inertia compensation.
18.48	**Select compensation torque**	Bit	Set if friction or inertia compensation is required.
18.26	**Material width**	mm *(ins)*	Enter material web width.
18.27	**Material density**	kgms/m^3 *(lb/ft^3)*	Enter the density of material
18.28	**Mandrel inertia**	kgm^2 *(lb.ft^2)*	Enter mandrel inertia
19.19	**Motor inertia**	kgm^2 *(lb.ft^2)*	Enter motor inertia, this can be obtained from the motor nameplate or from the manufacturer. If inertia compensation is not required set this parameter and 18.28 to 0.
19.15	**Friction loss**	0.1%	Enter frictional loss. This can be deduced by running the winder at low speed, with no material, and reading torque demand parameter 04.04. e.g. 10 = 1.0%
19.16	**Viscous loss**	0.1%	Enter the maximum viscous loss. This can be deduced by running the winder at maximum speed, with no material, and reading torque demand parameter 04.04. e.g. 10 = 0.1%. Allowing for the effect of 19.15.
19.45	**Select acceleration signal**	Bit	The rate of acceleration is used in calculating the acceleration torque. 0 – Acceleration determined internally from the analog line speed signal derived to parameter 19.25 or the serial line speed derived to 73.01 1 – Acceleration provided from an external source usually the main drive via parameter #73.02.
70.70 - 70.79	**Loss Profiler Speed Parameters**	r/min	Defines the loss profiler speed co-ordinates with respect to the % loss defined in parameters 71.70-71.79. Only applicable if parameter 18.48 = 1
71.70 - 71.79	**Loss Profiler % Loss Torque Parameters**	%	Defines the loss profiler % Loss torque co-ordinates with respect to the speed defined in parameters 70.70-70.79. e.g. 10 = 1.0% Only applicable if parameter 18.48 = 1
20.23	**Line speed signal differentiator sample time**	10ms	If the acceleration is to be derived from differentiating the line speed signal this sets the differentiator sample time. A Noisy acceleration signal maybe experienced if set too low. 1 = 10mS
	Status & Indication Parameters		
19.02	**Compensation torque**	Nm *(lb.ft)*	Derived resultant compensation torque, sum of inertia and loss compensation torques.
19.05	**Acceleration rate**	m/min/s *(ft/min/s)*	Line acceleration, derived from line speed signal or read directly from parameter 73.02.
70.55	**Loss Profiler Pointer**	-	Indicate current position in profile loss table.

Digital Control Parameters

These parameters are used to control the function of the winder software and will be controlled either by digital I/O or via serial communications.

No.	Description	Units	Comments
18.33	**Tension On command**	Bit	0 – Tension off 1 – Tension on
19.38	**Select Tension Set Point from parameter 19.26**	Bit	Tension Reference selection 0 – analog parameter 19.21 1 – Digital parameter 19.26
19.33	**Inch reverse command**	Bit	When set with the tension and the inch forward off, the winder will inch in the reverse direction at the inch speed defined in parameter 19.14
19.34	**Inch Forward command**	Bit	When set with the tension and the inch reverse off, the winder will inch in the reverse direction at the inch speed defined in parameter 19.14
19.35	**Select second diameter preset parameter 19.12**	Bit	19.35 = 0 Preset from 19.11 19.35 = 1 Preset from 19.12
19.36	**Run**	Bit	When tension is on (18.33=1) and Stall select parameter 19.36 = 0, 0 - Stall tension ref. is applied. 1 – Run tension ref. Is applied When tension is off (18.33-0) 0 – Stop 1 – Run at line speed or registered speed. See Control state diagram
18.41	**PID Enable**	Bit	0 – Disable PID 1 – Enable PID. In Torque mode PID enabled above Diameter HOLD speed. In Speed Mode PID enabled after centreing completed. Only use if load cell or dancer is fitted.
18.42	**PID Hold integral**	Bit	0 – Normal integration 1- PID Hold integrator
18.43	**PID Reset integral**	Bit	0 – Normal integration 1- Reset Integrator.
19.44	**Coupling enable**		0 – Stop 1 – Run at coupling speed(20.40) with current limit set (70.41)

Special Serial I/O Parameters

These parameters are used to control the function of the winder software and are intended only for use via serial communications.

No.	Description	Units	Comments
73.01	**Line speed**	0 -16000	Equivalent to 0 –Max Line Speed
73.02	**Line acceleration rate**	0 -16000	16000 equivalent to acceleration rate of 0 – Max line speed in 1 second
73.70	**Control word 0**		Allows sequence control via serial communication, see manual for bit allocation
73.71	**Control word 1**		Access to turret winder functions via serial communications, see manual for bit allocation
72.70	**Winder status word**		Allows winder status to be interrogated via serial communication see manual for bit allocation

.When using local communications connection on SM-Application module (e.g .RS485 or CTNet), these parameter can access directly, (e.g. _RXX% (or 72.XX) and _Sxx% (or 73.XX) register. When trying to access these parameter s from another SM option module (fieldbus, another SM-Application module) or the Unidirive-SP RS485 port then the routing address menu must be used. Please refer to the Unidrive-SP SM-option modules manual for more information.

5.5.2 Saving Parameters

These parameters configure the operation of the winder software and should be set and saved within the drive.

To save Unidrive-SP parameters to non-volatile memory:

- Menus 0-19
  Set parameter 00.00 = 1000 and press the reset.
- Menu 20
  This depends on which slot the SM-Application module is fitted, refer to section *Slot Menus* on page 17 for the correct slot menu. Set parameter ##.19 = 1. This parameter will automatically reset to 0.

6 Commissioning Sequence

Ensure that a hardware stop function has been provided and establish that it is operating correctly

Commission UniDrive & Motor as a standard closed loop speed controlled drive, ensuring motor maps and protection are configured.

Refer to the Unidive Documentation

Check mechanical and electrical idata for the winder and configure the relevant parameters

Refer to section 7.2

Establish the method of operation and ensure that the correct external sequencing control has been provided and the digital I/O correctly configured

Where serial data input and control is provided ensure that corect set point and control data is being received

Check that the internal configuration complies with the specific application requirements and controls, eg. Operating Mode, Unwind Mode Over / Under selection etc.

Ensure that the drives associated with other parts of the line are fully operational.

Thread the machine with material select Tension On and ensure that the material is correctly tensioned and ready to run

Start the main drive and check winder function at crawl speed. If all OK gradually increase the machine speed, ensure that the diameter function is operating correctly, ensure when LAP mode selected that the diameter incs or decs in the correct direction. Check displayed diameter against a measured value.

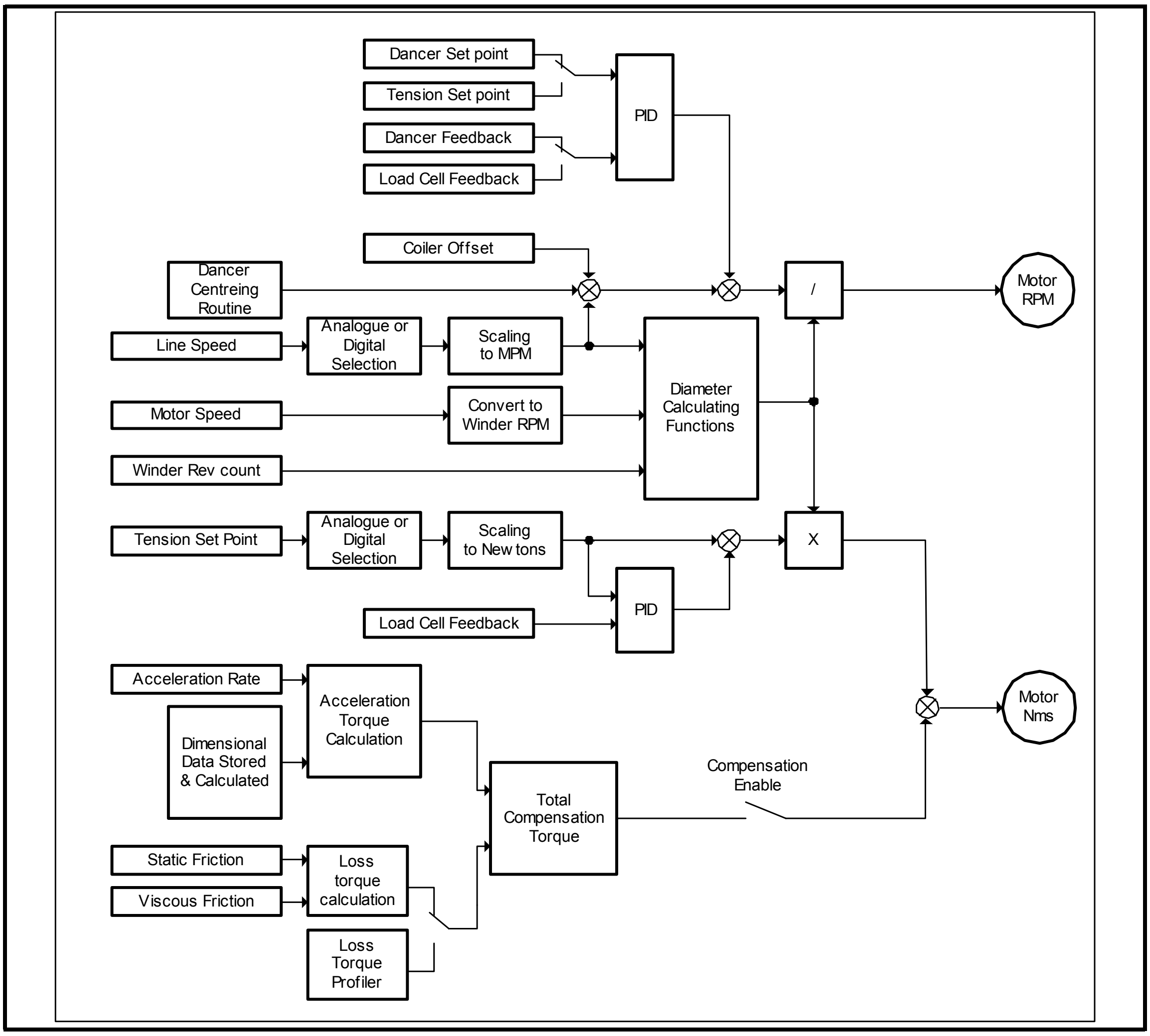
Run the machine through it's full range of speeds and check that tension is being controlled satisfactorily, observe the effects of inertia and loss compensation.

7 Functional Description

7.1 Overview

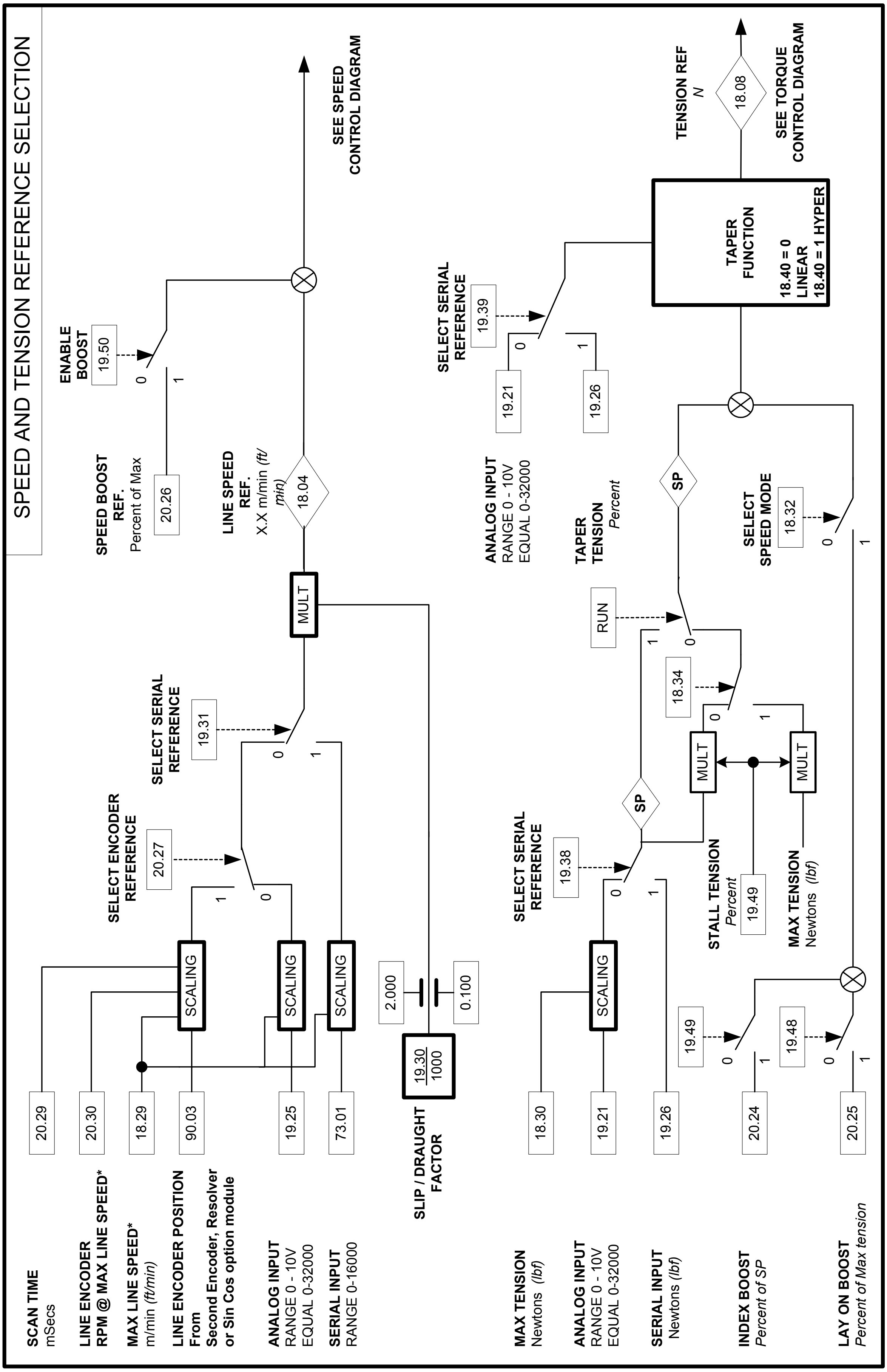
The diagram below illustrates the basic functions provided by the Winder application. Alternative operating modes ensure maximum flexibility of the package to suit the majority of centre driven winder requirements. The user interface is completely configurable allowing this application to be incorporated into complex systems where additional features may be required.

Winder Control Block Diagram

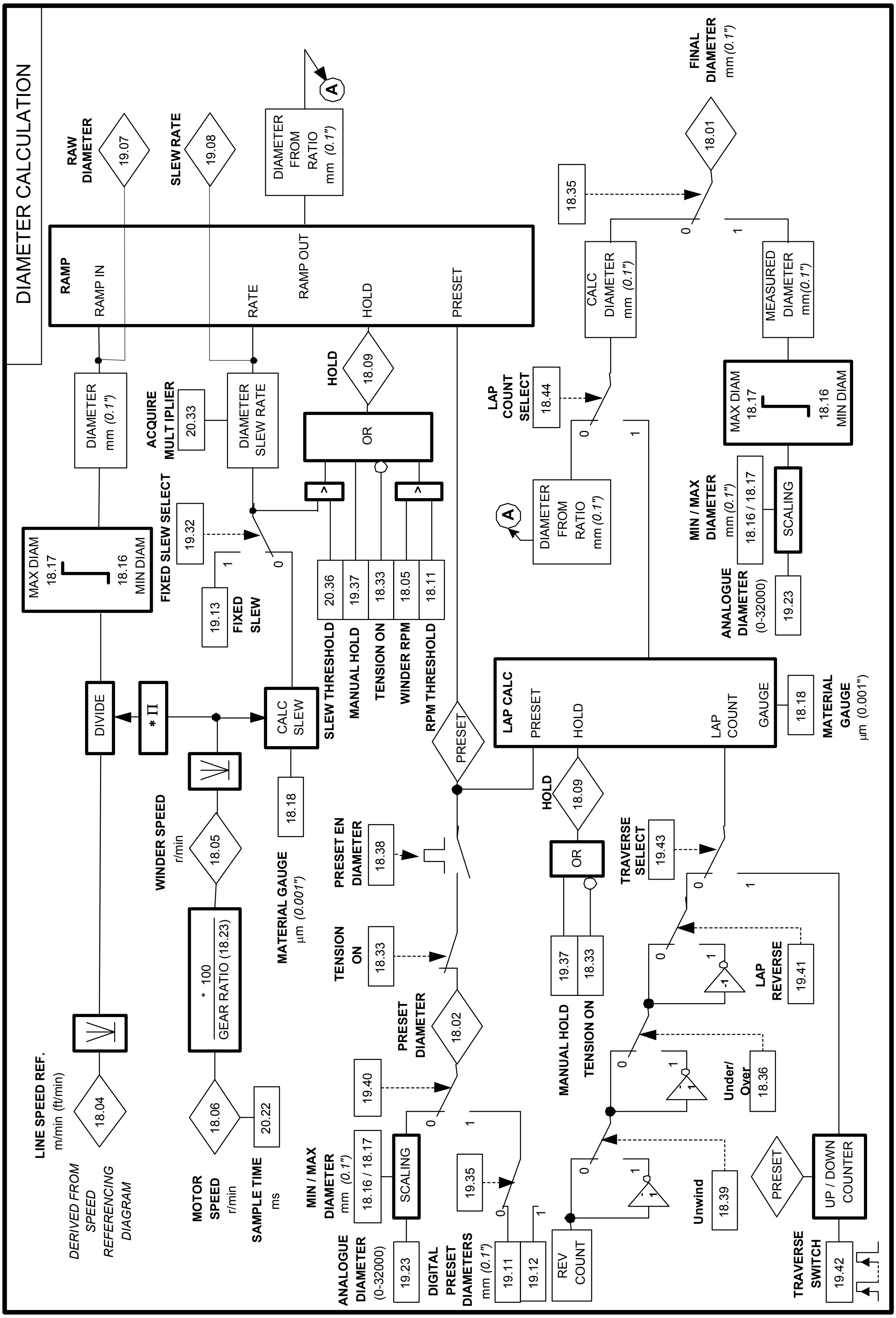


The Unidrive-SP winder software contains several basic calculation and control functions. Detailed overviews of the three basic blocks are shown below. A more detailed explanation is given under the relevant subheadings.

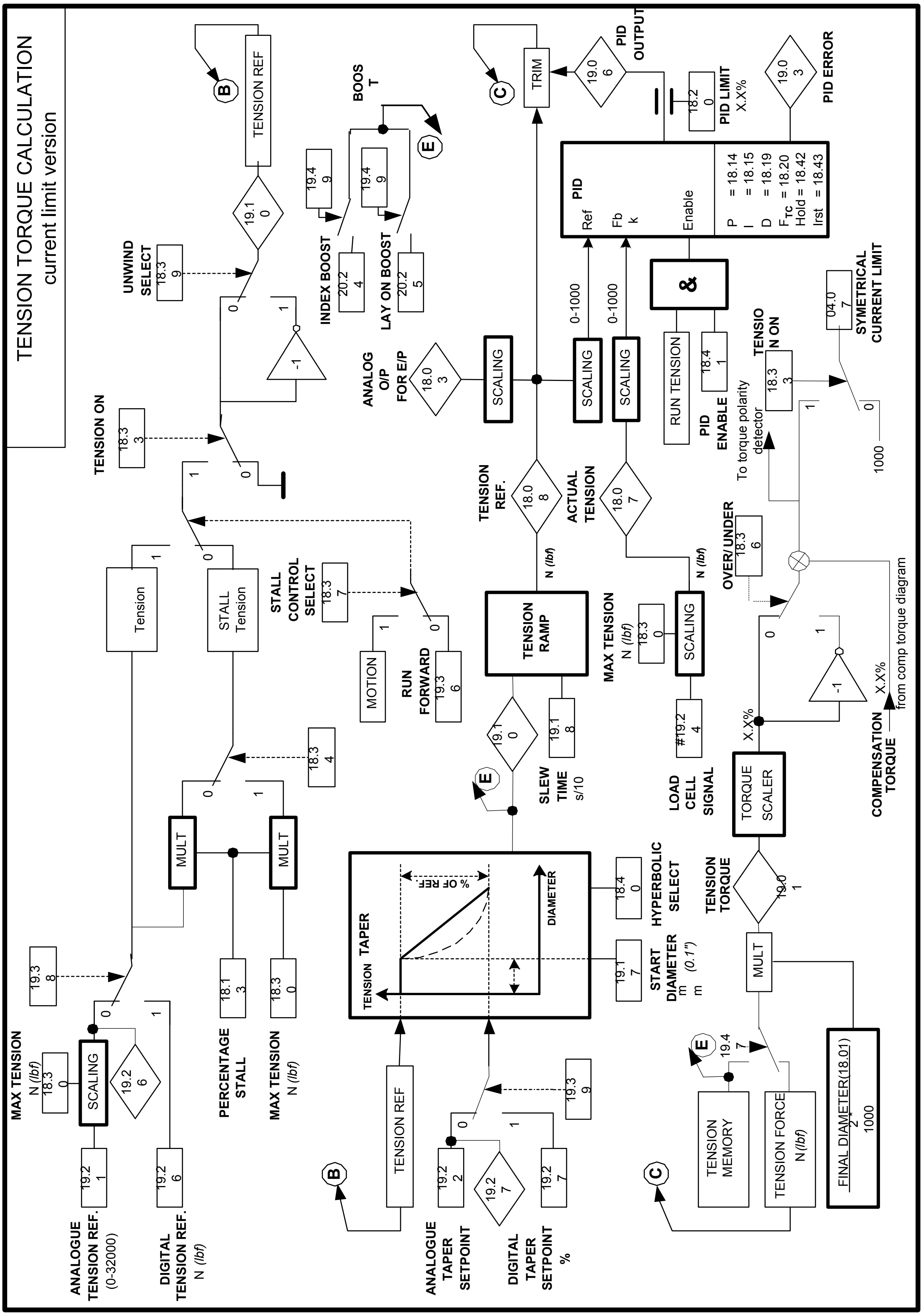
7.1.1 Speed and Tension Referencing overview



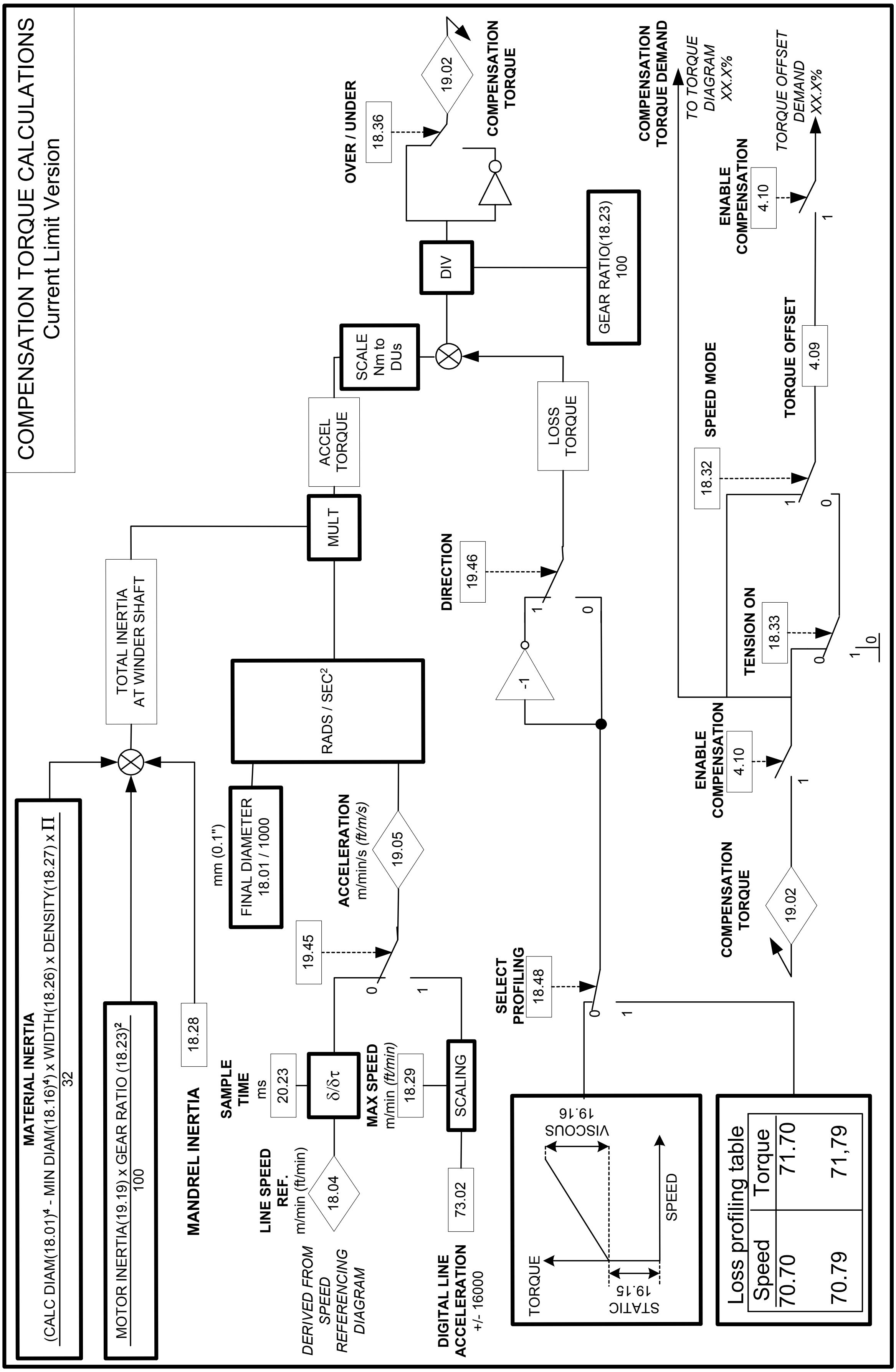
7.1.2 Diameter Calculation overview



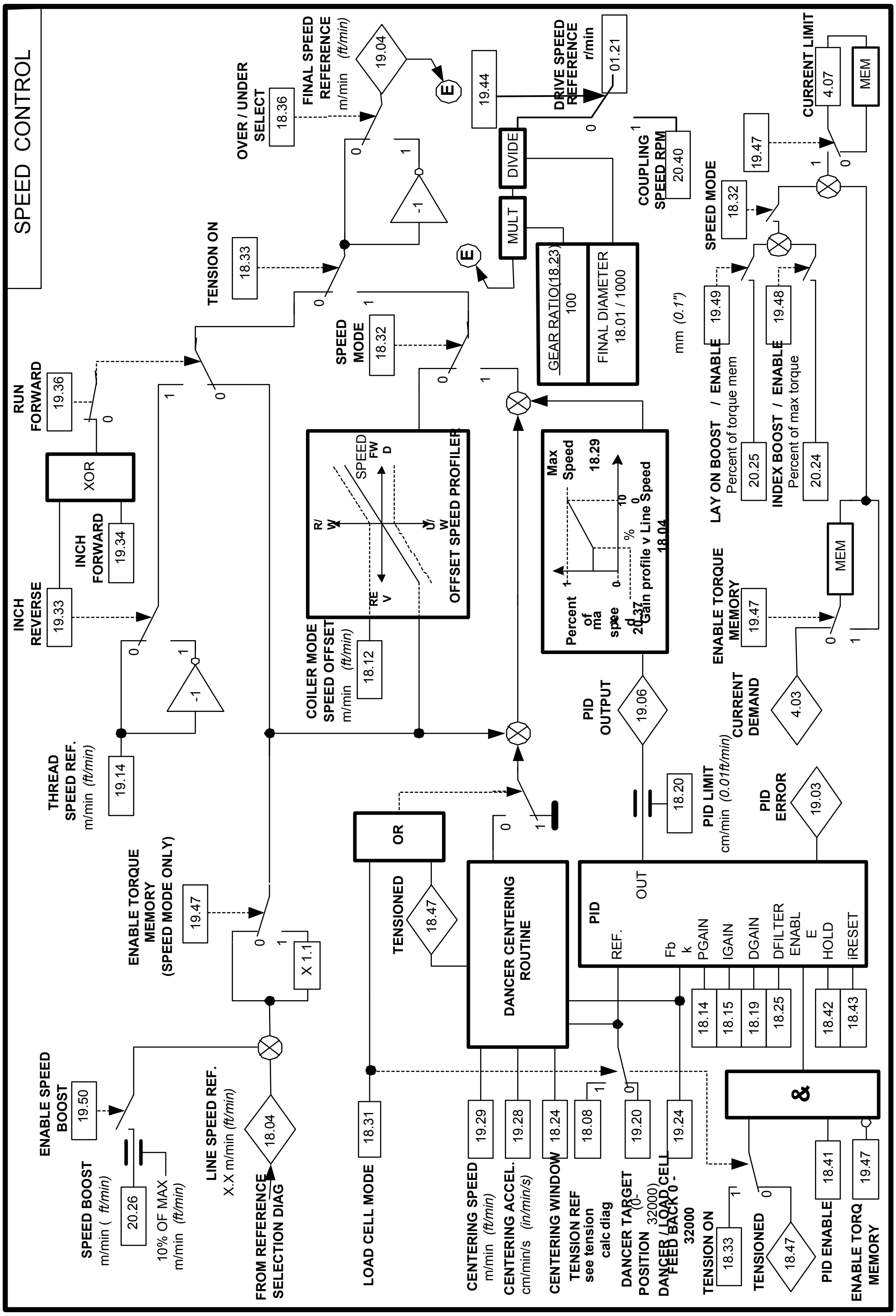
7.1.3 Tension Torque overview



7.1.4 Inertia and Friction Torque Compensation overview



7.1.5 Speed Referencing overview



7.2 Set Point Data Scaling & Selection

All active analog data received by the software is scaled into the relevant engineering units before being passed to the calculation blocks. A set of scaling parameters is provided for this function. Each scalar must be set to the maximum value for the specific application in the correct engineering units .Input data is scaled as follows:

$$\textbf{Value in EGUs} = \frac{\textbf{Analog I/P value * Scalar}}{\textbf{Analog scaling range}}$$

Where the scalar is equal to the maximum value in EGUs

Scalars are provided to convert

Input Data	Type	Data Range	Max Parameter (scalar)	EGU
Line speed	Analog	32767 (19.25)	18.29	m/min
	Digital	16000 (73.01)	18.29	m/min
Tension	Analog	32767 (19.21)	18.30	N
	Digital	N (19.26)	-	N
Diameter	Analog	32767 (19.23)	18.17	mm
	Digital	mm	-	mm

- The analog and digital line speed references are both scaled by the same EGU scalar, range selection is determined by the signal source.

When the analog input is sourced to the application analog parameter, the application analog parameter is automatically scaled to its maximum range with respect to the analog signal. For example, Analog 1 is to be assigned as line speed, therefore the destination parameter will have to be set as, 07.10 = 19.25, the input analog input range is -/+100.0 (07.01) the application parameter will be scaled respectively to its maximum, which is -32768 to +32767.

Line speed digital data received via CTNet or directly from other field bus sources should be scaled over the range 0 -16000 in order to maintain optimum resolution no matter at what speed the line is intended to operate, maximum speed is always being represented by 16000.

Where data is available from either analog or digital sources an individual selection bit is provided for each data channel, allowing a combination of analog and digital inputs to be selected. The status of the selection bit also determines the scaling range constant to be used in the conversion to EGUs.

Set point data which is input digitally is not scaled and should be entered in the relevant engineering units, For example Tension set point should be provided in Newtons directly from the MMI.

7.2.1 Line Speed Reference Sources

1. Analog 19.31 = 0, 20.27 = 0

The line speed reference used by the winder control software may be obtained from several alternative sources. In the default condition an analoq source operating over the range 0 - 10 volts is used and an analog input should be directed to 19.25 to provide this signal. Internally 10 volts will be represented by the maximum line speed value in 18.29 and the actual line speed reference in MPM (FPM) can be read in 18.04.

2. Encoder 19.31 = 0, 20.27 = 1

If the winder is to follow an encoder reference then 20.27 should be set to 1, the encoder input frequency is then scaled using the line encoder count per rev and:

20.29 Line encoder time base default 10 mSecs

20.30 Line encoder RPM at Maximum Line Speed

The result may be read in 18.04.

When the line encoder option is to be selected the drive must be provided with a suitable small option module. Suitable modules are:

- SM-Universal Encoder Plus module
- SM-Encoder Plus module
- SM- Resolver module

To ensure the software looks at the correct encoder, especially if more than one of the above option modules is fitted. If the SM-Applications firmware is V01.02.01, then SM-Application parameter ##.16 must be set to the option slot number the line encoder reference is be taken from. (For more details regarding slot and slot menu numbers refer to *Slot Menus* on page 17).

If the SM-Applications firmware is =>V01.03.00, ##.16 must be set to 0, and the encoder slots are selected by #70.65 (line/reference encoder) and #70.66 (feedback encoder), where 0 = Drive encoder input, 1 = Slot 1, 2 = Slot 2, 3 = Slot 3. After setting the Slots the SM-Applications module must be re-booted to action the change by setting x.00 to 1070, then press reset.

3. Serial 19.31 = 1

Setting 19.31 = 1 will provide the speed reference from 73.01 which is suitable to receive a cycle transfer via CTNet from the upstream master drive. This signal should be scaled 0 – 16000 to represent 0 – Maximum Line Speed. It is internally calibrated by 18.29 and the result may be read in 18.04.

A serial speed reference may be provide from any device capable of writing to 73.01, but the signal must conform the correct scaling 0 – 16000.

7.2.2 Use of Current Limit functions

The Unidrive-SP is provided with both symmetrical and polarity conscious current limit set up parameters. This application uses the symmetrical current limit 4.07 to control the current delivered to the motor when operating in torque control mode and also to set the torque level when operating in torque memory when using speed mode. User current limiting should therefore be set up using parameters 4.05 and 4.06 the forward and reverse bridge current limits. These should obviously be set to a value higher than the anticipated current required for tension control.

Removal of the run permit signal will cause all references to be removed from the drive resulting in deceleration to zero speed, the rate of deceleration will be determined by the forward or reverse current limit setting. This function therefore provides a very simple method of achieving a rapid stop in the event of an emergency.

Obviously during the stopping period the drive enable terminal must remain enabled and the contactor closed.

7.2.3 Length Count

Where the speed reference is provided from a line encoder, a material length count is also provided, the count appears in 70.19 and a count reset function is provided by 20.38.

7.2.4 Reference polarity and direction of rotation

In order to ensure correct operation of the software and achieve the required direction of rotation of the winder the following conventions must be followed.

All rotations are defined as looking on the front side of the winder (opposite side to the motor) and on the shaft end of the motor. If the installation employs either a direct drive or a belt drive both motor and winder directions of rotation will therefore be similar.

Default is considered as clockwise when following a positive line speed reference signal. Transporting material from an Unwind to a Rewind.

If the resulting direction of rotation of the re-winder is not as required then it may be reversed, by setting 18.36 = 1. If this results in the motor rotating anti clockwise then the diameter calculation by Lap counting will be incorrect, decrementing instead of incrementing, this can be corrected by setting 19.41 = 1. Conversely if the drive is selected to operate as an Unwind the diameter should decrement when running in the forward direction.

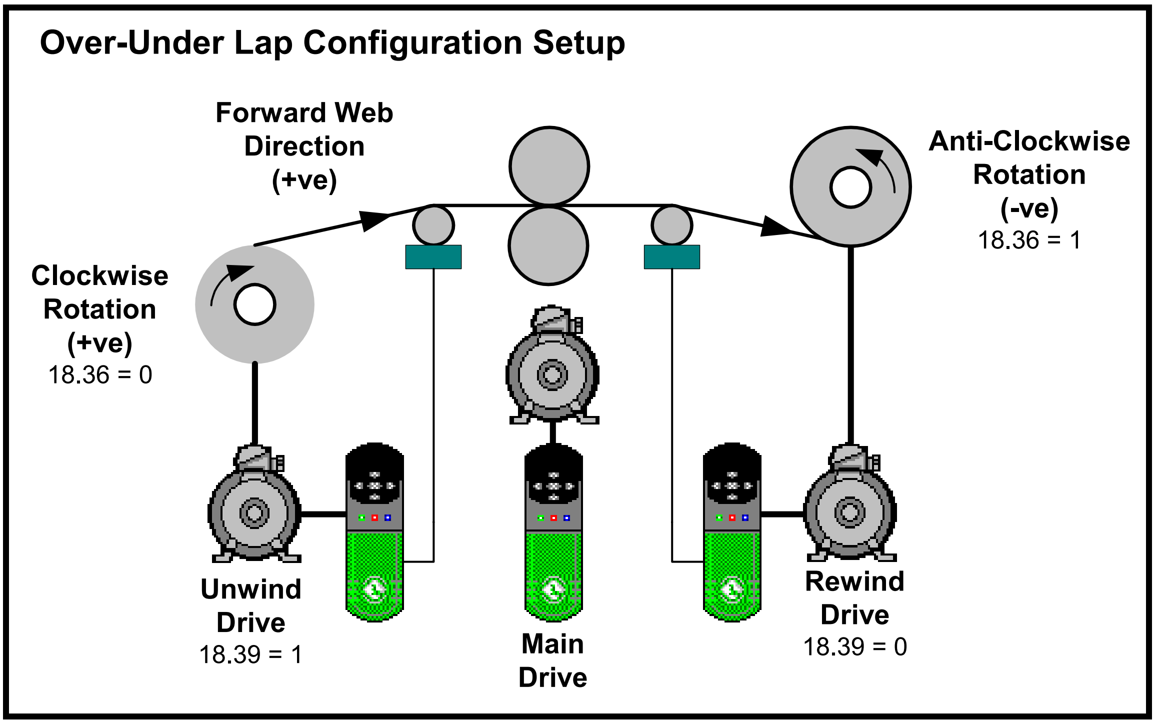
The drive may be selected to operate as an Unwind by setting parameter 18.39 = 1, this reverses the relevant signals internally producing a negative value for the tension reference in torque mode and reversing the action of the dancer centreing routine in speed mode.

Operation in Under or Over wind may be achieved by changing the setting of 18.36.

If the system is required to reverse, passing material from the drive defined as Rewind to the drive operating as an Unwind, this is simply achieved by providing a negative line speed reference signal.

No changes are necessary to the Unwind / Rewind selection bit 18.39 as the required torque directions do not change.

Negative line speed reference should only be used when reverse operation is required.



This is summarised in the table below.

Positive line speed reference

No reversal between motor and winder

Winder rotn	Motor rotn	18.36	19.41
CW	CW	0	0
CCW	CCW	1	1

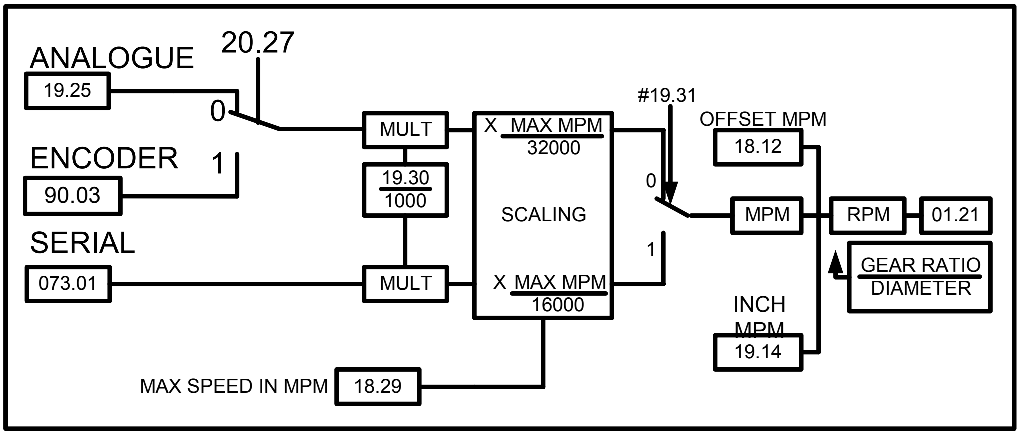
Reversal between motor and winder due to gearbox

Winder rotn	Motor rotn	18.36	19.41
CW	CCW	1	1
CCW	CW	0	0

If a drive is selected as an Unwind the settings above still apply, reversal of the line speed reference will result in the rewind operating as an Unwind and the Unwind operating as a Rewind. No changes to the configuration will be required.

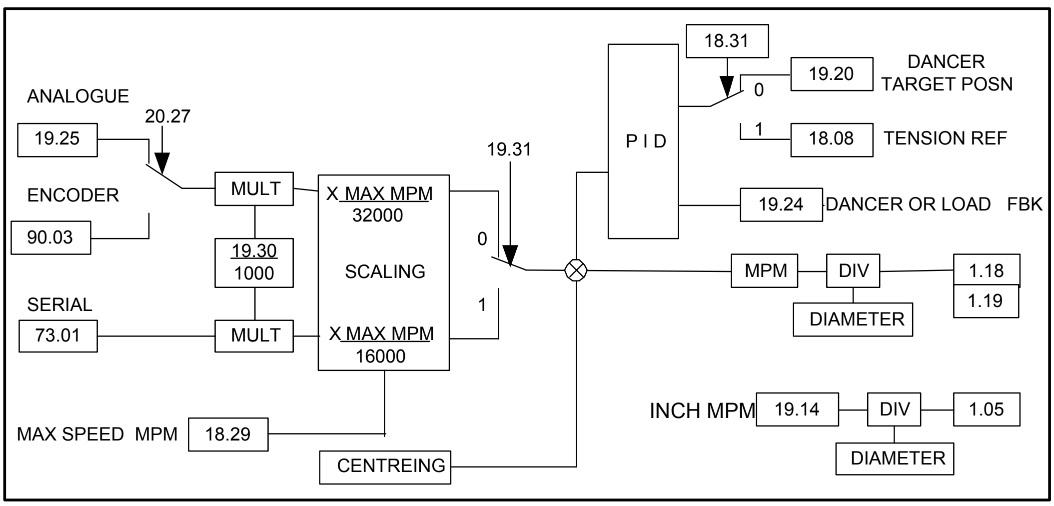
7.2.5 Speed Referencing (Torque Mode)

The following diagram illustrates the arrangement for line speed reference selection and scaling when operating in Torque control mode.



7.2.6 Speed Referencing (Speed Mode)

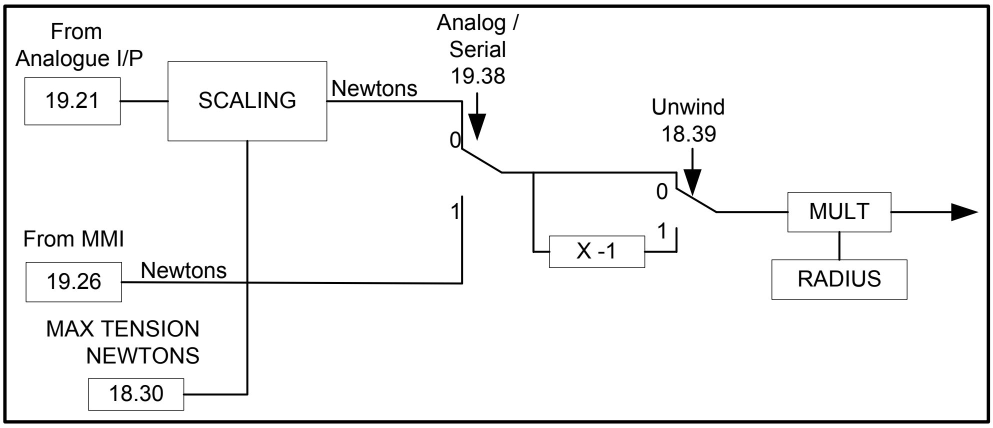
The following diagram illustrates the arrangement for line speed reference selection when operating in Speed control mode.



7.2.7 Tension Referencing (Torque Mode)

The following diagram illustrates the arrangement for Tension set point selection when operating in Torque control mode.

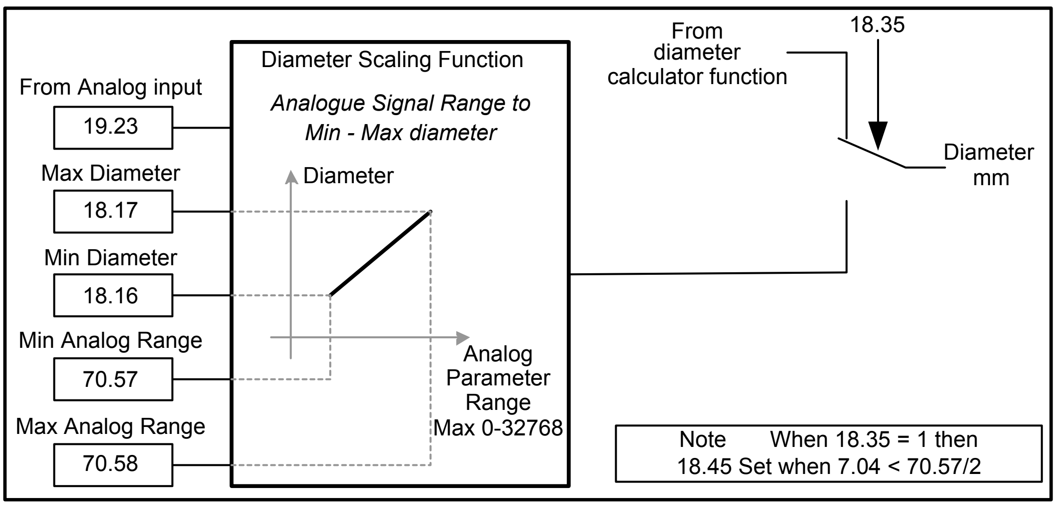
Tension set point can be allocated to either analog input 2 or 3. Scaling will be incorrect if analog input 1 is used.



7.2.8 Diameter Referencing (Direct measurement)

The following diagram illustrates the scaling and selection applied to direct diameter input via an analog input channel.

Diameter set point can be allocated to either analog input 2 or 3. Scaling will be incorrect if analog input 1 is used.



7.3 Diameter Measurement and Calculation

An accurate value of winder diameter is essential if the software is to maintain accurate control over the winder. The choice of method for diameter measurement is often determined by the particular application and to ensure maximum flexibility. Four options are provided:

1. By calculation – Speed Ratio (18.44 = 0: 18.35 = 0)
   Using the relationship:

   $$\textbf{Diameter} = \frac{\textbf{Line Speed in m/min}}{\textbf{Pi * Winder Speed (r/min)}}$$

2. By calculation - Lap Count (18.44 = 1: 18.35 = 0)
   Using the relationship:
   Diameter = Preset + (Material Gauge * 2 * Rev count)

3. By calculation – Traverse Lap Count (18.44 = 1: 18.35 = 0: 19.43 = 1)
   Using the relationship:
   Diameter = Preset + (Cable diameter * 2 * Traverse reverses)

4. By direct measurement (18.35 = 1)
   Using a transducer

Method 1 (Speed Ratio)

This method is selected as default, and is suitable for applications where a constant relationship between the speed of the master drive and the material is assured. Known slippage or draught effects can be catered for using the Slip Factor adjustment.

Because this method uses active values of line speed and winder speed it is self-correcting and will recover from errors due to incorrect preset diameter values entered by operators. However the calculation may only be performed above a minimum speed at which the speed feedback information becomes sensible. Various factors are provided to automatically freeze the calculation when data becomes unreliable see Diameter Hold.

Problems can occur when using this method due to variations in the speed signals causing transient disturbances to the calculated result, this leads to disturbances in torque output and hence tension. This effect has been minimised by limiting the rate at which the calculated diameter result is allowed to change - see Slew Limiting.

Method 2 (Lap Count)

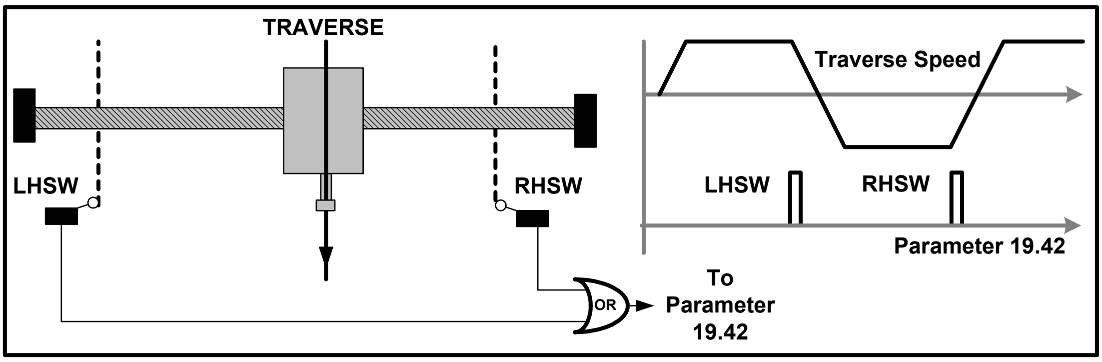
This can be selected (18.44 = 1) for applications where the speed of the material does not directly relate to the speed of the master drive. Typical examples include reducing mills where a considerable increase in material speed takes place due to the reduction process.

When using this method accurate data must be provided for diameter preset value and material gauge, as the system has no means of correcting any initial errors. Inaccuracies in gauge will cause an integral build up in the diameter result as winding progresses. In the metal processing industries where this approach is normally used these potential errors are not usually of any significance.

Because the lap counting function is based upon encoder position the direction of count may be incorrect for the particular set up, encoder direction will not necessarily comply with winder rotation due to gearing. Reversal Bit parameter 19.41 is provided to allow the increase or decrease in diameter to be matched to the actual arrangement. Diameter should increment for a rewind drive running in the forward direction (positive line speed reference) and decrement for a un-wind. Correct direction of winder rotation can be achieved using the over / under wind selection bit parameter 18.36.

Method 3 (Traverse Lap Count Mode)

This is an option to Method 2 and is selected when parameter 19.43 = 1, it is intended for cable traverse applications (rewind), where the diameter is increased by the twice the cable thickness at each reversal of the traverse. Traverse reversals should be signalled via parameter 19.42. Cable thickness should be entered as gauge in microns.



The Traverse mode may also be used for conventional web type materials where a once a revolution signal is generated from the machine, it is arranged to increment for rewind and decrement for unwind modes. The traverse counter must be preset in exactly the same manner as the normal lap counter.

Method 4 (Direct measurement)

This option is selected when parameter 18.35 = 1 can be used when some form of diameter sensing transducer is supplied. The transducer should be scaled to produce 0 – 10 volts in relation to the diameter range 0 – Maximum Diameter. This signal will then be correctly re - scaled by the software and will be displayed in millimetres in parameter 18.01.

Often in Unwind applications a diameter sensing transducer may be fitted but only used to provide the diameter preset value before start up. Methods 1 or 2 are then selected to provide continuous update of diameter once the machine is operating. Analog input and scaling functions are identical when using the transducer for both direct measurement and diameter presetting.

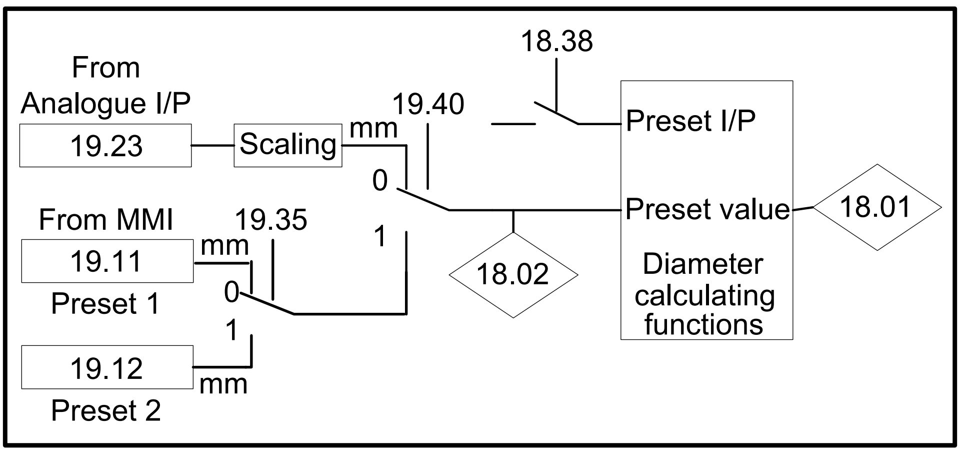
When analog diameter measurement is selected the diameter signal is monitored and if it falls below 50% of the anticipated minimum value the web tracking error flag 15.45 will be set to warn against loss of the diameter signal. The level of analog input equivalent to minimum diameter should have been entered in 70.57.

Overview of diameter calculating functions

7.3.1 Diameter Preset

When diameter calculation is used then at the start of a new wind the calculator output must be preset to the correct value. This is performed by momentarily setting parameter 18.38 = 1. Parameter 18.38 will automatically reset when the preset is completed.

The diagram below illustrates the preset diameter function.



The preset action can only be performed when parameter18.33 = 0, tension control not enabled.

Two preset diameter parameters are provided 19.11 and 19.12, both are calibrated in millimetres (tenths)

Parameter 19.23 provides a means of setting the diameter using an analog input, or alternatively it can be used as a third preset value if set up as below:

$$\textbf{Parameter 19.23} = \frac{\textbf{Preset Diameter * 32768}}{\textbf{Maximum Diameter}}$$

7.3.2 Diameter Slew Limiting

Variations in diameter due to misshaped rolls and noisy line speed reference signals can cause errors in the diameter calculation resulting in disturbances in torque and hence tension. This effect is reduced by imposing a limit on the rate at which the calculated result can change, the rate at which diameter will change depends upon the material gauge and the rotational speed of the winder.

The slew rate imposed by default is automatically calculated from this data, setting parameter 19.32 = 1 will select a user determined slew rate entered in parameter 19.13.

Additionally the direction in which the diameter calculator can move is polarised to match the duty.

- During a forward pass
  - Rewinds may only increase diameter
  - Unwinds may only reduce diameter
- During a reverse pass
  - Rewinds may only reduce diameter
  - Unwinds may only increase diameter

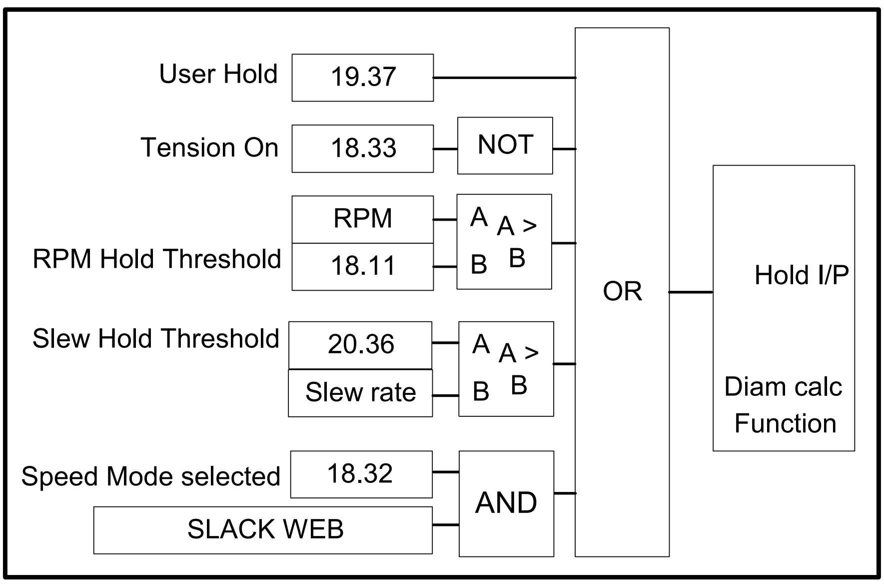
By applying these rules the software will prevent diameter errors due to run away under web break conditions.

7.3.3 Diameter Hold

At low speeds the result produced by the diameter calculator will become unpredictable. This level is set in parameter 18.11 in winder speed (r/min) and in parameter 20.36 in minimum slew rate.

The minimum slew rate is set on initial use to a default of 200.

An additional overriding user Hold function is also provided by setting parameter 19.37 = 1.



7.3.4 Acquire Diameter

Under certain conditions it may be advantageous to increase the diameter-slewing rate to allow the ratio calculator to catch up and correct an error. This situation can occur if a new roll is loaded and the diameter calculator has not been preset to the correct value. The acquire function allows the slewing rate to be increased by a multiplying factor 20.33. A suggested starting value is 100 implying that the diameter calculator will change at 100 times it's normal rate. The acquire function is only available when operating as a speed winder, the PID must be enabled and the web tight between winder and adjacent machine. A slack web will cause an incorrect diameter result as the relationship between web machine speed and winder speed will be incorrect.

Two options are provided:

- Acquire on start up
- Acquire on demand

Acquire on start up is enabled by setting 20.34 = 1, in which case the slewing rate will be increased for a set period from the instant the diameter hold function is removed as the machine accelerates. Having timed out this function will only activate again once the tension on command has been removed and the winder is restarted.

Acquire on demand is activated by an external signal setting 20.35 = 1, this signal will normally be produced by a PLC and should be programmed as a pulse lasting about 2 to 3 seconds. An internal timer will cancel this function after 10 seconds. The Acquire on demand function may be called at any time.

7.3.5 Slack Web Detection

Slack web detection is provide by the software, it is enabled by setting 20.31 = 1 and operates by sensing the dancer or load cell feedback signal falling below a threshold set in 20.32 range 0 – 1000 to represent full dancer movement.

To establish the value to be set into 20.32:

Using a Dancer

Move the dancer to it's lowest (slackest) postion dancer signal must reduce as the web slackens. Read the value in 19.24 Dancer feed back, the range of this parameter is 0 – 32768. Note - this may be restricted by limited dancer movement. Divide the reading by 32 and enter in 20.32.

Using a Load Cell

Establish the range of tension over which the winder is required to operate and set 20.32 at a percentage value below the lowest anticipated percentage tension, 10% tension is represented by 100 in 20.32.

The slack web indication is used when operating the winder in speed mode to Hold the diameter calculator and also to signal a web break. It is up to the user to determine action in the event of a web break, the web break bit 18.46 is internally latched until the drive is disabled but has no affect on the operation of the drive.

7.3.6 Coupling

The coupling function allows the winder to be rotated at constant speed referenced in RPM instead for MPM, whilst the coupling splines align ready for engagement. The speed reference is entered in 20.40 and the function is enabled when 19.44 is set on. Coupling is handled by the sequencer in a similar manner to the jog function, 19.44 should therefore be maintained on for the period during which rotation is required.

During coupling the drive current limit is reduced to allow stalling whne the coupling engages, the coupling current limit level is entered in 70.41. Coupling speed may be set over the range of ±10 r/min referred to the winder shaft.

7.3.7 Non Volatile Diameter Storage

During normal operation the value of the calculated diameter is continuously written to a non-volatile register 70.99. The contents of this register are used to re-initialise the diameter during power up.

7.3.8 Web Break Detection

Web breaks will cause a mismatch between winder peripheral speed and line speed this mismatch causes a sudden change in the calculated diameter and is detected by the software. Two levels of error are detected.

When using the winder in Speed mode the slack web detection flag is also used to detect a web break.

> Parameter 18.45 is set if a small diameter error occurs.
>
> To avoid trips due to transient conditions the error condition must exist for 500 milliseconds before the flag is set.

This will indicate incorrect set up of the preset diameter or in lap count mode - possibly an incorrect gauge setting.

> Parameter 18.46 is set if a mismatch between calculated winder peripheral speed and line speed is detected.
>
> A delay of 100 milliseconds is provided to filter out any transient errors.

This indicates a web break and will operate in both ratio and lap count diameter calculating modes.

When operating in torque mode the increase in winder peripheral speed is limited to the value set as coiler offset, the web break mismatch threshold is set at 50% of this value. In speed control mode the increase in speed will be limited by the clamp applied to the output of the PID speed trim, to overcome difficulties in detecting speed errors when the clamp is set to a low value, the PID in limit flag is monitored as a second factor in the web break detection function.

The web break flag is latched within the winder software until the drive is disabled. The tracking error flag is not latched. Neither of these flags generates any action within the winder software and they should therefore be monitored externally. Operation of either of these flags does not have any effect on the operation of the winder software.

When Analog diameter measurement is selected the diameter tracking error flag 18.45 will be set if the analog signal falls below 50% of the minimum anticipated value set in 70.57.

The tracking error and the web break trips, are inhibited by the Hold diameter and minimum slew rate thresholds. To prevent spurious trips occurring around zero speed, if increased sensitivity is required these thresholds may be reduced below the default settings.

7.3.9 Loss of Analog Diameter Feedack

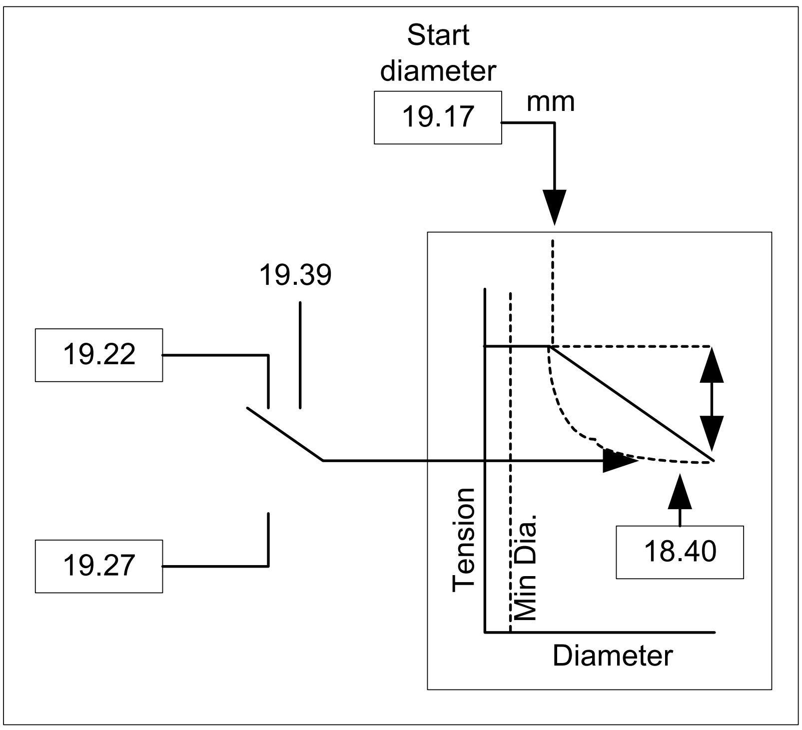
When the analog input is selected as the source of diameter measurement, the level of the signal received from the diameter measuring device is constantly monitored if it falls below 50% of the anticipated minimum level the diameter tracking error flag 18.45 is set.

7.4 Taper Tension

Some materials wind more satisfactorily when the tension is reduced as the diameter increases.

The amount of Taper or tension reduction is set as a percentage achieved at maximum diameter. Reduction is performed linearly or hyperbolically and can either start from the mandrel diameter or a point part way through the diameter range.

Taper set point adjustment is made available in both analog and digital format. The diagram below illustrates the options for set up and control.



Normally, Taper tension will not be available when operating a winder in Speed Mode as the control strategy is to maintain dancer position against a fixed restraint (e.g. a spring). The tension is therefore determined by the spring rate.

If Taper Tension is required then the dancer mechanism must be arranged to accept a load reference from the drive, usually this is achieved using an E/P transducer controlled from an analog output and a pneumatically loaded dancer mechanism. In which case the system must be provided with Tension and Taper set point data as would be provided for a Torque winder.

7.5 Torque Compensation functions

Feed forward torque references are produced to compensate for winder frictional losses and inertia. These functions are not normally required when operating in Speed Mode, but systems requiring rapid acceleration may benefit from the use of inertia compensation.

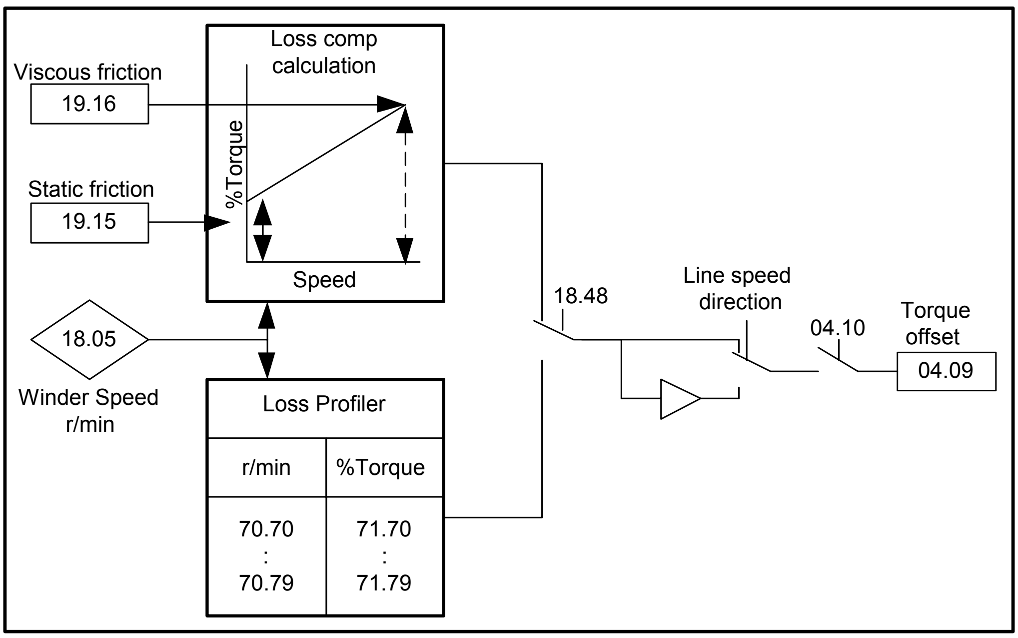
Torque controlled winders operate by predicting the required torque to achieve tension, if the loss or acceleration torques are significant compared to the tension component then it will be very difficult to obtain satisfactory tension control.

Acceleration torque can be accurately predicted providing the correct dimensional data is provided at set up. However predicting the frictional losses of the winder is more difficult as losses tend to change with temperature and time. Where the losses amount to more than about 10% of the tension load then it is recommended to employ closed loop tension control using some form of direct tension measurement.

The compensation values are inputted to the drive via the torque offset parameter 04.09, therefore to enable compensation parameter 04.10 must be set 1.

NOTE Winders should be designed to operate with the minimum friction load; worm reduction gearing should be avoided where possible. The best results will be obtained when the motor is directly coupled to the winder shaft. For small reductions in speed toothed belts provide a more efficient speed reducer than a gearbox.

7.5.1 Loss Compensation



The polarity of the loss compensation signal is dependant upon winding direction. When rewinding the losses have the effect of reducing the effective tension and the compensation torque must be added to the tension torque component. When unwinding the opposite condition exists and the loss torque must be subtracted from the tension torque. This polarity selection is performed automatically within the software by checking the polarity of the line speed reference signal. The loss compensation torque function is illustrated below.

The result is indicated by Compensation Torque parameter 19.02.

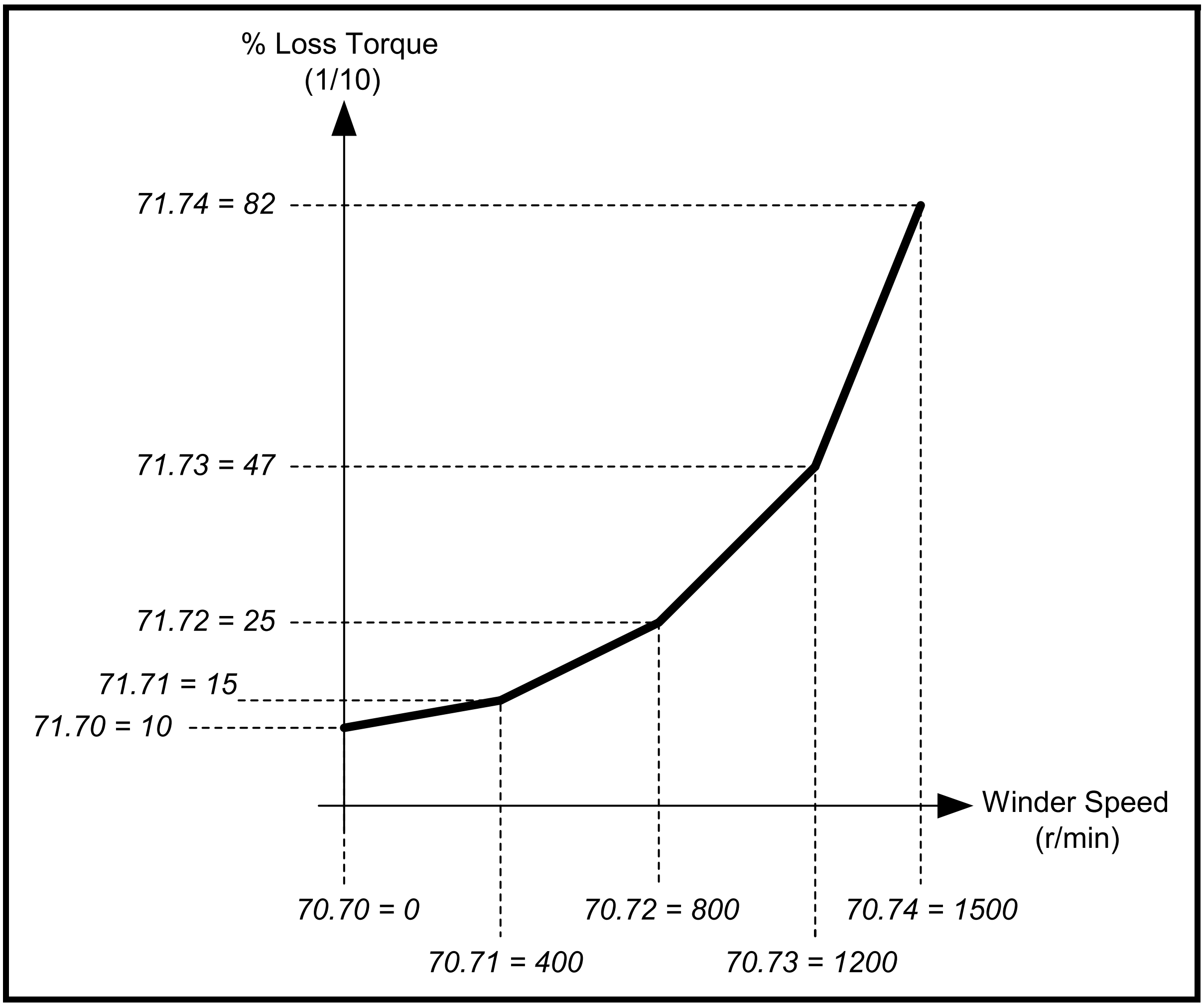
Simple Loss Compensation (18.48 = 0)

Loss compensation is split into two components losses due to static friction and losses due to viscous friction.

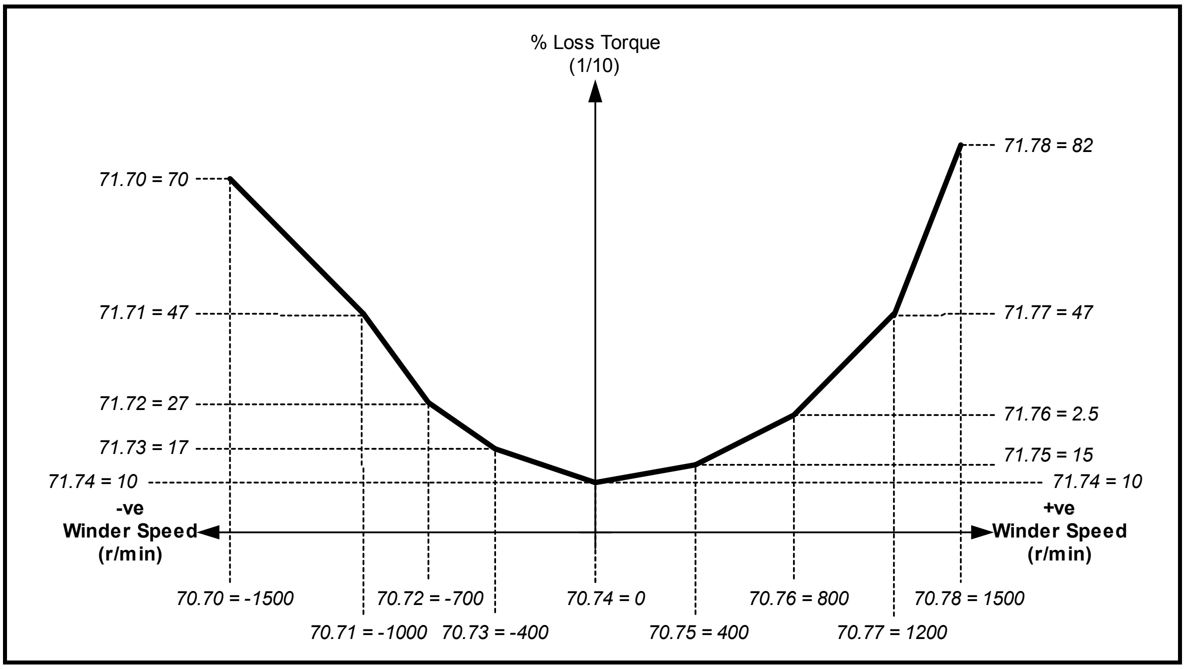
Profile Compensation (18.48 = 1)

Using the profiler the losses can be more closely matched to the load. The profile allows the losses to be entered at different speeds within the controllable range, up to 10 points maximum. The speed values are stored in parameter 70.71 to 70.79 and the corresponding percentage loss torques values are stored in parameters 71.70 to 71.79. The profiler uses linear interpolation between each point as the winder speed increases or decreases. The speed can be entered as positive or negative values therefore losses can be profiled for uni-directional or bi-direction winders; - see examples below.

Uni-polar speed direction example



Bipolar Speed Direction Example (Reversing Mill)



To derive the percentage loss torque parameters for given speed value, the winder will have to run in speed mode without any material. The following procedure could be used:

1. Disable the Winder program.
   ##.13=0
   00.00=1070 and preset reset (red button on keypad).
2. Set Drive to keypad mode and run
   01.14=4
3. Press green button on keypad.
4. Set the winder speed by pressing the up and down arrows on the keypad.
5. Select appropriate speed set points for profile from approximately 1 to max winder rpm (at min diameter).
6. At each speed set point enter the speed value to the appropriate Menu 70 parameter and load the corresponding % loss torque in menu 70 with value displayed in parameter 04.03.

NOTE Not all 10 points are required to be set, provided the last point is at maximum.

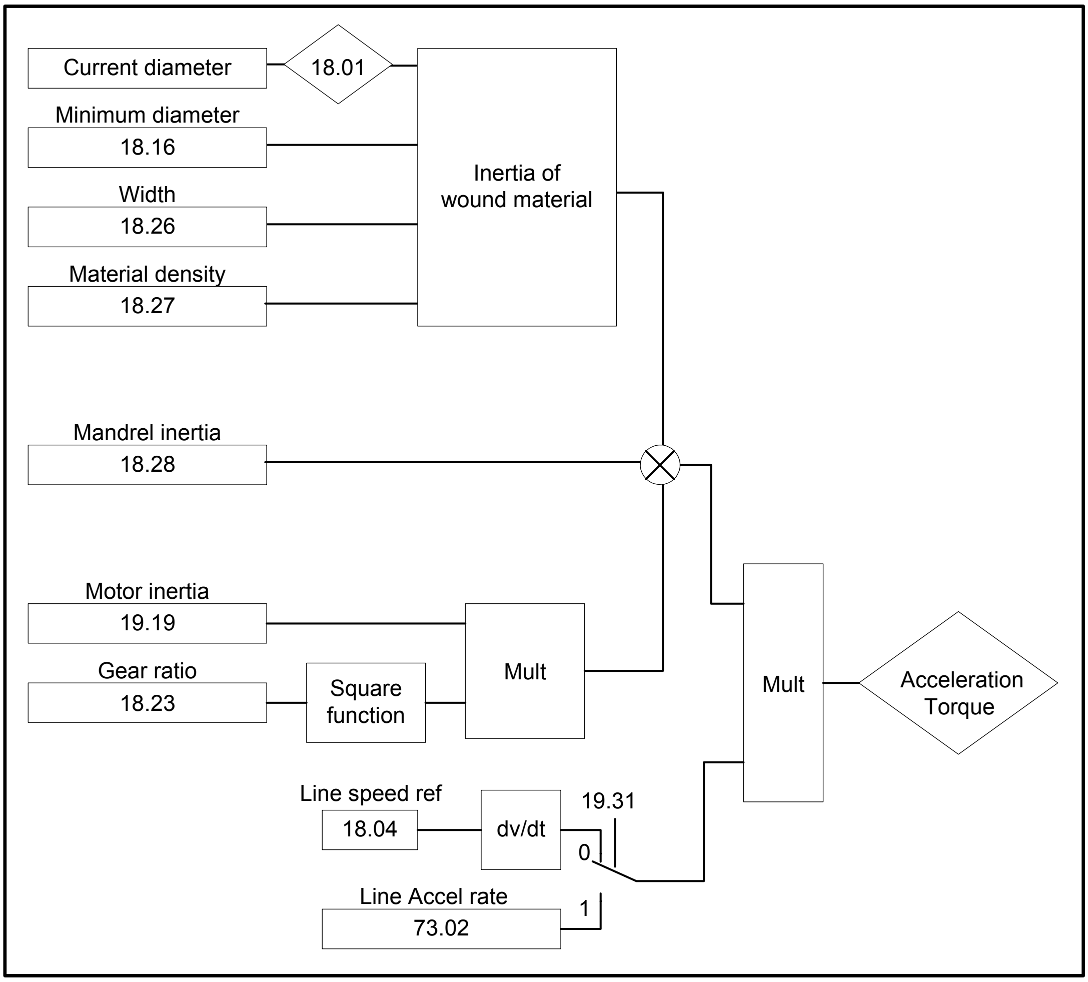
7. When completed stop drive by press the red button on keypad.
8. Re-enable the winder program.
   ##.13=1
   00.00=1070 and press reset (red button on keypad).

NOTE The loss profiler parameters are automatically saved on power down so they do not require to be manually saved.

7.5.2 Inertia Compensation

The total inertia of a winder system is considered as two parts, the fixed inertia component which includes the inertia of the motor and the winder machinery and a variable component due to the material being wound. In this system the fixed components are entered and stored in parameters and the variable component is continuously calculated from the dimensional data held in the software. It is therefore important that fairly accurate values are entered during set up, and, if varying widths of material are to be wound, the width parameter should be updated to match the product.

The inertia compensation function is illustrated below.



Alternative sources of acceleration rate are available; default selection 19.31 = 0, selects the output from a differentiator, which monitors rate of change of the line speed reference. Setting parameter 19.31 = 1 reads a value from parameter 73.02 which can be updated from an external source such as the suitably scaled current DX output from an S Ramp function block generator in the master drive.

Scaling of this input signal should be arranged as follows:

$$\textbf{Parameter 73.02} = \frac{\textbf{Actual m/min / second} \times \textbf{16000}}{\textbf{Maximum m/min}}$$

When a CTNet system is used then a cyclic data link may be set up to pass this signal to the winder from the master drive.

The externally sourced signal is preferred, as the output from the differentiator is invariably noisier. Adjusting its scan time using parameter 20.23 may optimise the output from the differentiator.

The acceleration rate is displayed in parameter 19.05 in metres per minute per second.

7.6 Speed Control functions

Several auxiliary functions associated with controlling the speed of the drive are necessary to ensure satisfactory operation as a winder. The software from the value of line speed and current diameter predicts the desired winder speed. This speed is then used as the reference speed for the drive, if a gearbox is fitted then the speed is modified to account for gear ratio (18.23).

In speed controlled applications this final motor speed is trimmed by the PID in relation to the position feedback signal obtained from the dancer. In torque controlled applications this speed is used together with a speed offset value to provide the speed limit used by the drive when operating in torque mode.

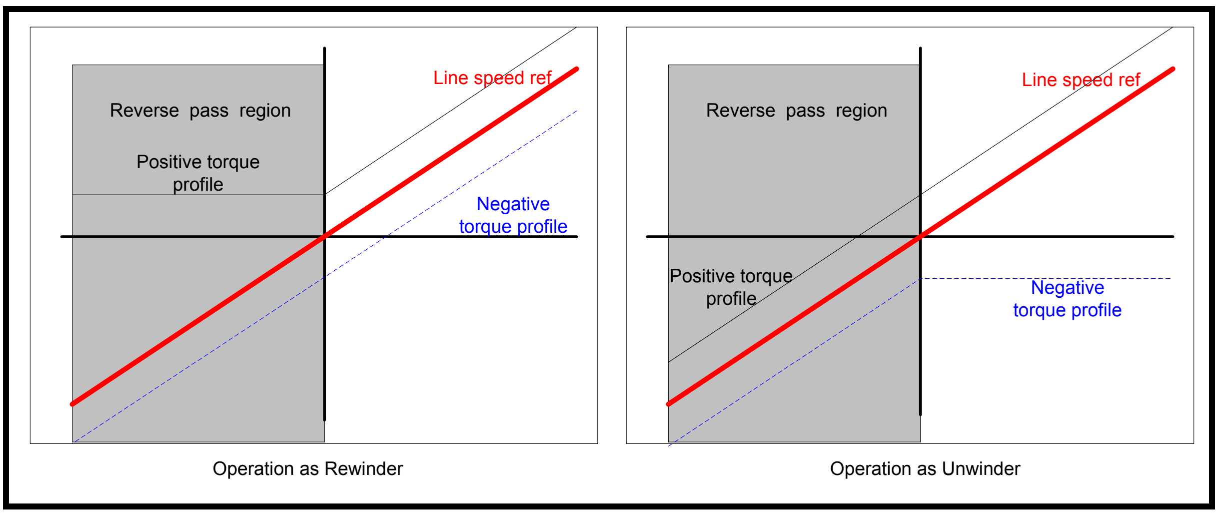
Initial positioning of the dancer during start up in speed control mode is performed by a centreing routine.

7.6.1 Speed Offset for Torque Control

In Torque control mode the Unidrive remains in speed control but it's speed reference is increased to cause it to try to over-speed, forcing it into current limit. To achieve this the Unidrive requires a speed reference, which is marginally higher than the anticipated speed of the winder, where the speed reference is too low the drive will come out of current limit and revert to speed control. It is essential that the speed offset is set high enough to maintain the speed controller in saturation at all times during winding.

Tension and compensation torques are summed and used to determine the level of current limit thereby setting the current at the desired level.

An offset speed function generator combines the offset value (18.12 or Alternative 70.35) with the line speed reference to ensure that the final speed reference applied under torque control modes is correct under all conditions of winding and unwinding, see below. The speed offset is enabled when the Tension On bit parameter 18.33 is set to 1. The polarity of the speed offset is matched to the selection of wind or unwind and the torque demand as illustrated below.

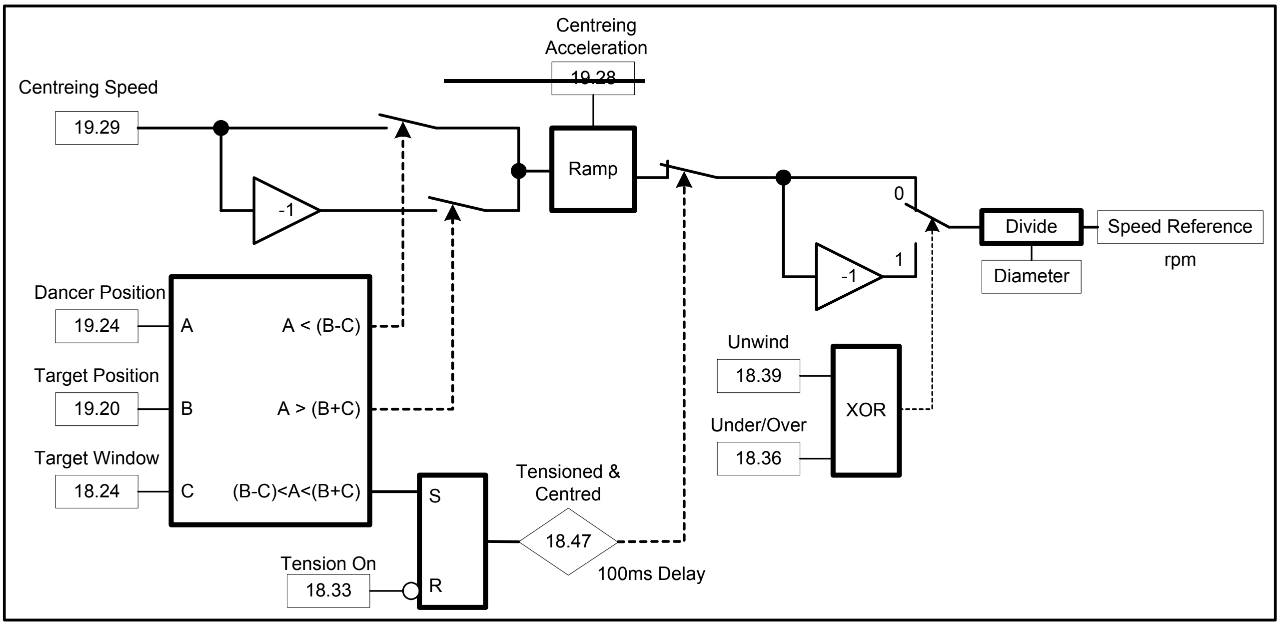


7.6.2 Dancer Centreing Routine

The dancer centreing routine is a one shot operation, which occurs when the winder is selected to Tension On with the PID enable bit set, it is only active when operating the winder in Speed control mode. It's function is to ensure that the dancer is located within controllable limits before the PID controller becomes active. The PID action is inhibited internally until the centred flag has been set, at which point the centreing routine is cancelled and the PID takes control. Further action by the centreing routine is prevented until the centreing flag has been reset which occurs when the Tension On bit is reset.

The centreing routine provides a speed reference, which causes the winder to take up or pay out material and move the dancer into a predefined target area.

It is suggested that the PID enable should be set at all times when operating in this mode.



7.7 PID Control

PID controllers are provided for both Torque and Speed modes of operation. In torque mode, a load cell will normally provide the feedback signal, although in certain instances a dancer could be used. In speed mode the tension feedback may be provided from a dancer as a positional feedback or from a load cell as a measure of actual tension. In both instances the output of the PID provides a trim to the final reference signal before it is passed to the drive. This trim will normally be very small as the actual required speed or torque references; will be accurately calculated by the software.

It is essential that the feedback signals are of the correct polarity and when used as a direct measurement of tension they must be correctly calibrated. The signals should be positive and arranged to increase in a positive direction with increasing tension/position. In the case of load cells they must be selected for the correct range of tension to be controlled and correctly calibrated with test loads applied at the correct entry and exit angles. Where dancer control is used if a potentiometer is to provide the measure of dancer position then this potentiometer should be of the plastic tracked variety and suitably mechanically robust. Mechanical end stops should be provided to prevent overrun of the potentiometer.

Differences in the effect of the PID between Rewind and Unwind installations are taken care of within the software.

In speed mode a low value of feedback to the PID, (negative error) results in an increase in speed of a drive operating as a rewind and a reduction in speed of a drive when operating as an unwind.

In torque mode a low tension feedback, (negative error) will result in an increase in re-winder torque (motoring) and a decrease in un-winder torque (braking).

7.7.1 Load Cell Calibration

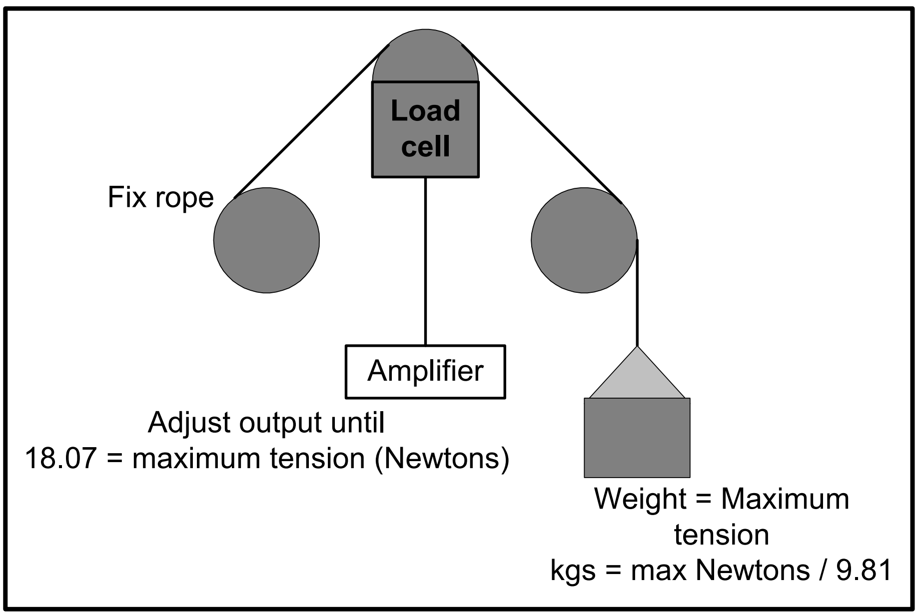
Load cells may be used to provide direct measurement of material tension various configurations are used. The most common being two load cells located at each end of the tension measuring roll, their outputs being summed in the associated amplifier to produce a signal proportional to total tension. Other arrangements use split rolls with more load cells distributed along the length of the roll again their outputs being summed in the amplifier. Simple systems may have only one load cell mounted at one end of the roll, the other end being mounted in a flexible support operating as a hinge.

What ever the mechanical arrangement load cells are always provided with a signal conditioning and summing amplifier which converts the millivolt signal from the cell to a usable voltage range usually 0 –10 Volts.

An output calibration potentiometer is normally provided to adjust this output voltage to suit the installation. When using load cells ensure that they are specified for the range of material tension to be measured, various ranges are available from tens of Newtons up to thousands of Newtons. If the load cell range is too great compared with the tension it is to measure then the tension signal will have very poor resolution.

To calibrate the load cell apply test weights equal to the anticipated maximum tension supported by ropes or webbing which has been threaded through the machine following the material path. The total weight applied should be equal to the maximum tension. The output calibration can then be set to provide a tension feedback signal, monitored in parameter 18.07, that is equal to maximum tension in Newtons.

1 kg = 9.81 Newtons 1 lb = 4.45 Newtons

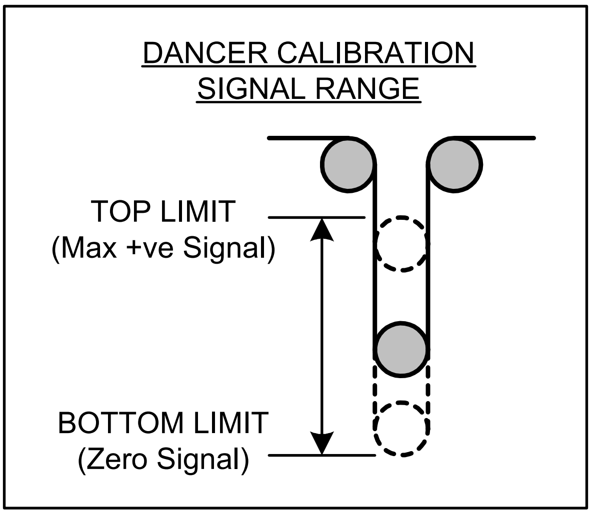


7.7.2 Dancer Calibration

The Dancer feedback signal should be directly proportional to dancer position, it should be arranged to produce 0 – 10 Volts to represent the full range of dancer travel. Increasing voltage should correspond to increasing tension. The target position for the dancer can be set in parameter 19.20. A 0 – 10 volt input span will result in an internal range of 0 – 32768, setting 19.20 = 16000 will therefore aim the dancer at mid position.

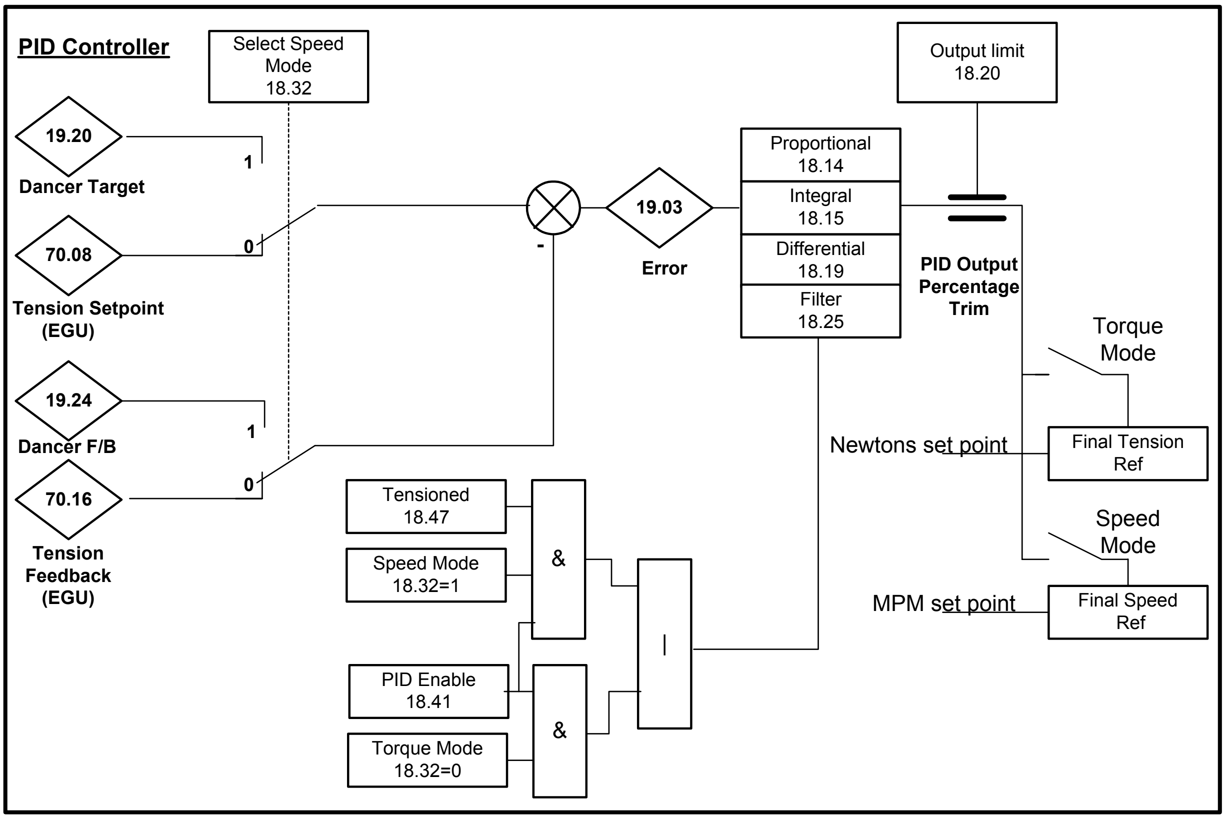
If the dancer mechanism has only limited voltage output range then the minimum and maximum extremes should be established and the target position set mid way between the minimum and maximum values.

The software has no provision for a negative excursion of the dancer feedback signal; any movement producing a negative signal will therefore be treated as zero.



7.7.3 PID Description

The PID (Proportional Integral Derivative) provides closed loop regulation to maintain process consistency and compensate for external disturbances. In winder applications it can be used to correct any non-linearity in the drive / motor torque generation function and reduce the tension errors caused by mechanical losses.



7.7.4 PID Operation (Torque Mode 18.32 = 0)

The Tension set point (19.26) represents the demanded value to be reached, and the Tension feedback (18.07) is the current, actual value being read from the tension transducer. The set point and the feedback are compared and the difference between these values represents the tension error (19.03). The tension error is used to perform a percentage trim on the final tension demand before it is converted to a torque demand for the motor to force the Tension feedback to equal the Tension set point. The response & the regulation accuracy of the process is dependant on the PID gain setting.

7.7.5 PID Operation (Speed Mode 18.32 = 1)

Using dancer feedback 18.31 = 0

The Dancer target (19.20) represents the position at which the dancer is to be maintained, and the Dancer feedback (19.24) is the current, actual position of the dancer. The set point and the feedback are compared and the difference between these values represents the dancer position error (19.03), which in turn is proportional to the tension error as determined by the dancer spring rate. The position error is used to perform a percentage trim on the final linear speed demand before it is converted to an angular speed demand (r/min) for the motor to force the Dancer feedback to equal the Dancer set point. The response & the regulation accuracy of the process is dependant on the PID gain setting.

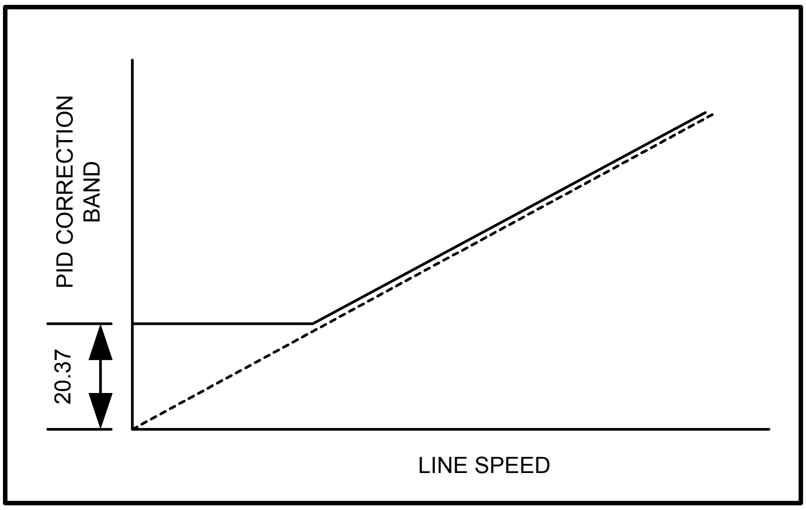
Using Load cell feedback 18.31 = 1

Under this mode of operation the set point for the PID is derived from the tension set point and the feed back from a load cell, the PID is therefore providing a speed trim signal to control the tension directly. The tension error is used to perform a percentage trim on the final linear speed demand before it is converted to an angular speed demand (r/min) for the motor in order to maintain the load cell feedback signal equal to the tension set point. This arrangement an adjustable tension set point and also allows Taper tension to be included. The response & the regulation accuracy of the process is dependant on the PID gain setting.

7.7.6 PID Output Profiling

Often it is beneficial to provide allow increased corrective action from the PID at higher line speeds. This is due to the increased length of material on which the control system is having to control tension as the line speed increases. However if the range of correction is reduced in direct proportion to the line speed then inadequate correction may be available at reduced speed. Parameter 20.37 sets the percentage of maximum line speed below which the PID action will be held constant.

If 20.37 is set to 100 then the action available from the PID will be constant throughout the speed range.



7.7.7 Proportional Gain Kp (18.14)

The Proportional gain is the instantaneous amplification factor that is applied to the process error.

$$Pout = Kp \cdot \varepsilon$$

The Proportional term must have an error to produce an output. The magnitude of the output is dependant on the magnitude of the error and the amount of proportional gain.

For an error of 1, and a Proportional gain of 1000, the output of the P term will be 1. The Gain is set as a fixed-point integer.

7.7.8 Integral Gain Ki (18.15)

The integral gain is amplification factor of the error over time.

$$I_{out} = (K_I \cdot \int \varepsilon . \delta t) / 10$$

The integral term accumulates any error over time to helps reduce any offset or long-term errors such as frictional losses or discontinuities drive torque linearity. K_i is a multiplication co-efficient of the integrated value.

For a constant error of 1, and an Integral gain of 10, the output of the Iterm will reach 1 after 1 second. The Gain is set as a fixed-point integer.

7.7.9 Differential Gain Kd (18.19)

The derivative gain is amplification factor of the rate of change of error.

$$D_{out} = (K_d \,.\, \delta\varepsilon/\delta t) / 10$$

The Differential term is the rate of change of the error multiplied by the Kp co-efficient. This is responsive during transient conditions; therefore it is zero during steady state condition. It is useful to reduce the overshoot during large disturbances. The differential gain is rarely used in most applications as it will amplify any unwanted noise to the system and can cause instability.

For a constant rate of change of error of 1 count per second and a differential gain of 10, the output of the D term will be 1. The Gain is set as a fixed-point integer.

PID Output

The PID output is the summation of all the terms above as follows:

$$PID_{output} = \left[\left(\frac{Kp \cdot error}{1000} \right) + \left(\frac{Ki}{10} \cdot \int error \cdot dt \right) + \left(\frac{Kd}{10} \cdot \frac{d_{error}}{dt} \right) \right]_{\text{Min Limit}}^{\text{Max Limit}}$$

The PID output is clamped between symmetrical limits, which are the Min and Max trim ranges by which the torque or speed can be adjusted set 18.20. These limits define a working area within the PID. If the output crosses one of the limits, the PID output will be clamped until the output returns within these limits. The limits will also stop the integrator accumulating until the integrated error is back in the working range.

7.8 Reversing Mill Applications

Reversing Mill applications require the winder drives to alternately operate as un-coilers and coilers, setting up this software to operate in this manner is simple.

The Coiling and Uncoiling system torque polarities must conform to the following truth table.

Line Forward (+ve speed reference)

Mode	Tension	Losses	Inertia Comp
Coiler	+ve	+ve	+ve/-ve
Un-coiler	-ve	+ve	+ve/-ve

Line Reverse (-ve speed reference)

Mode	Tension	Losses	Inertia Comp
Coiler	+ve	-ve	-ve/+ve
Un-coiler	-ve	-ve	-ve/+ve

When applying this package to reversing applications remember that the tension polarity does not change when the line direction reverses. Coiler and Un-coiler direction will be determined by the material being wound the software will automatically determine the correct polarity for the loss and inertia compensation signals from the polarity of the line speed and acceleration rate signals received from the master drive.

Example – Setting up a reversing mill configuration

When configuring a reversing system with Unwind and Rewind, define line forward as the direction from De-Coiler to Re-Coiler and set Unwind mode (18.39=1) for the De-Coiler only. To run the system simply, set the forward command Term on both drives. A Forward pass is defined as running from De-Coiler to Coiler with a positive, line speed reference signal. When the line runs in the opposite direction a negative line speed reference signal must be provided.

The system will automatically take care of all internal torque polarity selections. Tension polarities will be set to pull away from the central nip. Inertia compensation and loss compensation torque polarities will be determined by the polarity of the line speed reference signal.

7.9 Turret Winder Features

Several features are provided which are specific to the requirements of Turret Winders and Flying Splice applications. Most turret winders are designed to the same basic set of principles. The turret rotates to allow either of two rolls of material to be processed, winding or unwinding. A mechanism is provided to allow the material from an incoming roll to be spliced onto the end of the material from and expiring roll at the unwind or conversely from a full roll to an empty mandrel at the rewind. This ensures that the machine can run continuously at normal production speeds, with no necessity to stop and start for roll changes. Splicing can be achieved satisfactorily on machines running up to approximately 2000 metres per minute.

Each spindle on the turret assembly is equipped with a winder motor and drive control system, it is not possible to share spindle drives if the spindle drive is used to accelerate the incoming roll whilst the expiring roll is running.

Some systems provide a separate surface belt drive to accelerate the incoming roll, in which case the winder spindle motors may share a common drive controller with associated changeover contactors etc. This arrangement can often be found on News Press reelstands.

7.9.1 Torque Memory Function

Speed Mode

During a changeover, tension feed back from the load cell or dancer must be transferred from the expiring roll to the incoming roll, to avoid problems during this period the expiring roll drive can be switched from speed control with PID trim to torque control running at a level of torque measured just prior to the start of the changeover process. Using this feature avoids difficulties due to disturbances affecting the load cell being fed into the winder control system.

On completion of a changeover the drive will normally be returned to speed control and ramped to zero speed.

Torque Mode

Torque memory is also available when operating in torque mode, if problems occur during turret indexing or roll transfers then enabling torque memory will set the torque reference at the previously active value of it’s tension component and hold it until torque memory is disabled.

The torque boost functions described below are not affected and may be used with or without torque memory being enabled.

The torque memory mode is enabled by 19.47.

7.9.2 Index Torque Boost Function

Whilst a turret is being indexed the material tension may suffer a disturbance due to the change in attack angle of the material and the effective change in material length as the turret rotates. A facility is provided within the software to adjust the running torque to compensate for this effect.

The value is set as a percentage of actual torque (tension). This function operates on the tension set point when operating in torque mode or on the memorised torque value when using torque memory.

Index torque boost is enabled by 19.49 and the value is set by 20.24.

7.9.3 Speed Boost Function

Once the new roll is in position then it must be accelerated so that it's peripheral speed matches the line speed, this is achieved by presetting the correct diameter into the drive and provided a line speed reference signal. The incoming diameter can be input by the operator using an MMI or similar device, or it can be read from an ultrasonic scanning device. Often in order to achieve 100% repeatable splicing on an unwind it can be advantageous to provide a slight over speed of the incoming material, a speed boost feature is provided to perform this function.

Speed boost is enabled by 19.50 and the value is set in 20.26. The value is calibrates on MPM and is limited to a maximum of 10% of maximum line speed.

7.9.4 At Line Speed Function

Splicing applications on turret winders require a signal to confirm that the winder peripheral speed has achieved the correct value to allow a splice or roll change to commence. The acceptance window for this signal is set in parameter 70.42 in 0.1 mm or 0.1 fpm. The target line speed is taken as actual line speed plus speed boost, once the actual peripheral speed of the winder is within the window of this level the at line speed, bit 11 of the Status word will be enabled.

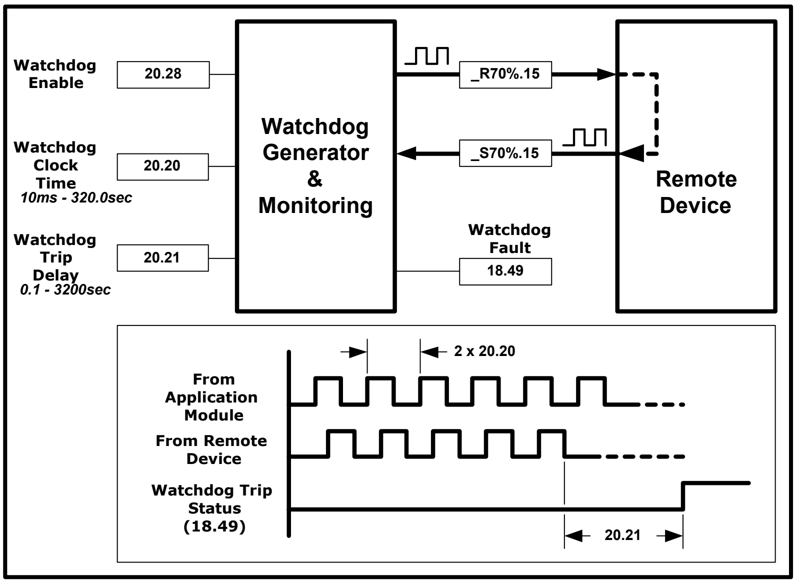
7.9.5 Lay On Roll Torque Boost Function

The final operation in the changeover sequence the web being defected towards the surface of the new roll in readiness for the splice. A roll generally termed the Lay On roll performs this function. The Lay On roll is not driven and therefore presents an extra drag on the material possibly resulting in a tension disturbance.

Lay On roll torque (tension) boost is enabled by 19.48 and the value set in 20.25. The value is set as a percentage of maximum tension.

7.10 Communications Watchdog

The Watchdog is used to provide a mechanism to ensure the safe operation when movement is being controlled from a remote device. The watchdog checks that the remote device is online and capable of both sending and receiving data. This is done by sending a clock signal to the remote device, which responds by resending the same clock signal back, the returned signal is then monitored to make sure that the received data is of similar clock period to the sent data.



8 Parameter Descriptions

8.1 Unidrive-SP Parameters

The following parameters listed are only relevant to this application (in closed loop mode). A short description of the parameter is given but for more information please refer to the Unidrive-SP manuals.

Manual Description	CT Part Number
Unidrive-SP User Guide	0471 - 0000
Unidrive-SP Advanced User Guide	0447 - 0002 - XX

8.1.1 Menu 1

01.01	Level of reference selected
Coding	RO, B, P
Range:	±40000.0
Units:	r/min

Indication of the reference being used by the drive is given for system set up and fault finding.

01.06	Maximum Speed Clamp
Coding	RO, B, P
Range:	±40000.0
Units:	r/min

Defines drive absolute maximum speed reference.

The Application software controls this parameter.

01.07	Minimum Speed Clamp
Coding	RO, B, P
Range:	±40000.0
Units:	r/min
Default settings:	0.0

Defines drive absolute minimum speed reference. If the system is to operate in both directions then this parameter should be set to allow reverse speed to be achieved.

The Application software controls this parameter, setting = 0.

01.10	Bipolar reference select
Coding	RW, B,
Default settings:	0

If the user requires changing the direction of rotation with a bipolar reference, this parameter should be set. If it is not, all negative references are treated as zero.

The Application software controls this parameter.

01.11	Reference enabled indicator
Coding	RO, Bit, P

The drive sequencer defined in Menu 6 controls this indicator. This is set when commanded to run with the drive enabled and healthy.

01.14	Reference selector
Coding	RW, Uni
Range:	0-5
Default settings:	0

This parameter is used to select a speed reference as follows:

0 Analogue 1. & Analogue 2 *Selected by terminal input
1 Analogue1.or Preset Speed References*
2 Analogue2.or Preset Speed References*
3 Preset Speed References Only
4 Keypad Reference
5 Precision Speed Reference.
(*Preset reference dependant on parameter 01.15)

The Application software controls this parameter, setting = 3.

01.15	Preset selector
Coding	RW, Uni
Range:	0-9
Default settings:	0

This parameter is used to select a preset speed reference as follows:

0 Preset selection by terminal input
1 Preset 1 selected
2 Preset 2 selected
3 Preset 3 selected
4 Preset 4 selected
5 Preset 5 selected
6 Preset 6 selected
7 Preset 7 selected
8 Preset 8 selected
9 Preset selection by timer

The Application software controls this parameter, setting = 1.

01.21	Preset Speed reference 1
Coding	RW, Bi
Range:	±40000.0
Units:	Hz
Default settings:	0.0

Preset speed reference 1.

This is the speed reference is derived from the application software within the UD70.

The Application software controls this parameter.

8.1.2 Menu 2

02.01	Post ramp speed reference
Coding	RO, Bi, P
Range:	±Max Speed 01.06
Units:	Hz

This is the speed reference after the ramps. The range of this parameter is restricted so that it cannot be larger than the range set by Pr 01.06 (maximum speed clamp) and Pr 01.07 (minimum speed clamp).

02.02	Ramp enable
Coding	RO, Bit
Range:	0-1

This parameter is controlled by the application.

The Application software controls this parameter.

02.04	Ramp mode
Coding	RW, Txt
Range:	0 – 1
Default settings:	2

This parameter has 3 settings as follows:

0 FASt Fast ramp

1 Stnd.Ct Standard ramp with ramp control

The acceleration ramp is not affected by the ramp mode, and the ramp output will rise at the programmed acceleration rate (subject to the current limits programmed in an closed loop drive).

Application Recommended setting = 1 or 2.

02.10	Acceleration Selector
Coding	RW, Uni
Range:	0 – 9
Default settings:	0

This parameter is used to select acceleration ramp rates as follows:

0 Ramp rate selection by terminal input
1 Ramp rate 1 selected
2 Ramp rate 2 selected
3 Ramp rate 3 selected
4 Ramp rate 4 selected
5 Ramp rate 5 selected
6 Ramp rate 6 selected
7 Ramp rate 7 selected
8 Ramp rate 8 selected
9 Ramp rate selection by preset reference selection

Application Recommended setting = 1.

02.11	Acceleration Rate
Coding	RW, Uni
Range:	0.0 - 3200.000
Units:	Seconds / 1000 r/min

This sets the Acceleration rate for Post ramp reference to ramp up to Pre ramp reference, when Post ramp reference is less than Pre-ramp reference.

02.20	Deceleration Selector
Coding	RW, Uni
Range:	0 – 9
Default settings:	0

This parameter is used to select Deceleration ramp rates as follows:

0 Ramp rate selection by terminal input
1 Ramp rate 1 selected
2 Ramp rate 2 selected
3 Ramp rate 3 selected
4 Ramp rate 4 selected
5 Ramp rate 5 selected
6 Ramp rate 6 selected
7 Ramp rate 7 selected
10 Ramp rate 8 selected
11 Ramp rate selection by preset reference selection

Application Recommended setting = 1.

02.21	Deceleration Rate
Coding	RW, Uni
Range:	0.0 - 3200.000
Units:	s/1000 r/min

This sets the Deceleration rate for Post ramp reference to ramp down to Pre ramp reference when Post ramp reference is greater than Pre-ramp reference.

8.1.3 Menu 3

03.05	Zero Speed Threshold
Coding	RW, Uni
Range:	0 - 200
Units:	R/min^1

If the speed feedback (parameter 03.02) is at or below the level defined by this parameter in either direction the Zero speed flag (parameter 10.03) is 1, otherwise the flag is 0.

3.08	Overspeed threshold
Coding	RW, Uni
Range:	[01.06] – 40,000
Units:	R/min^1

If the speed feedback (parameter 3.02) exceeds this level in either direction an overspeed trip is produced.

03.10	Speed Controller Proportional Gain Kp1
Coding	RW, Uni
Range:	0.0000 - 6.5335
Units:	$1/rs^{-1}$

Proportional gain (Kp)

If Kp has a value and Ki is set to zero the controller will only have a proportional term, and there must be a speed error to produce a torque reference. Therefore as the motor load increases there will be a difference between the reference and actual speeds. This effect, called regulation, depends on the level of the proportional gain, the higher the gain the smaller the speed error for a given load. If the proportional gain is too high either the acoustic noise produced by speed feedback quantisation (using digital encoders, resolvers, etc.) becomes unacceptable, or the closed-loop stability limit is reached (using SINCOS encoders).

03.11	Speed Controller Integral Gain Ki1
Coding	RW, Uni
Range:	0.00 - 653.35
Units:	1/rs

Integral gain (Ki)

The integral gain is provided to prevent speed regulation. The error is accumulated over a period of time and used to produce the necessary torque demand without any speed error. Increasing the integral gain reduces the time taken for the speed to reach the correct level and increases the stiffness of the system, i.e. it reduces the positional displacement produced by applying a load torque to the motor. Unfortunately increasing the integral gain also reduces the system damping giving overshoot after a transient. For a given integral gain the damping can be improved by increasing the proportional gain. A compromise must be reached where the system response, stiffness and damping are all adequate for the application. The integral term is implemented in the form of _(Ki x error), and so the integral gain can be changed when the controller is active without causing large torque demand transients.

03.12	Speed Controller Differential Feedback Gain Kd1
Coding	RW, Uni
Range:	0.00000- 0.65335
Units:	s

Differential gain (Kd)

The differential gain is provided in the feedback of the speed controller to give additional damping. The differential term is implemented in a way that does not introduce excessive noise normally associated with this type of function. Increasing the differential term reduces the overshoot produced by under-damping, however, for most applications the proportional and integral gains alone are sufficient.

03.34	Number of encoder lines per rev
Coding	RW, Uni,
Range:	0-50,000

8.1.4 Menu 4

04.01	Motor current magnitude
Coding	RO, Uni, P
Range:	0 to maximum drive current
Units:	Amps

This parameter is the rms current from each output phase of the drive.

04.07	Symmetrical Current Limit
Coding	RW, Uni
Range:	0 to 400%
Units:	% of rated active current
Default settings:	150

This sets the symmetrical current as a percentage of Motor rated current.

04.09	Percentage Torque Offset (Compensation)
Coding	RW, Uni
Range:	0 to 400%
Units:	% of rated active current
Default settings:	150

This parameter is written to from the Winder software, and is used for the Compensation torque reference. To enable this, parameter 04.10 must be set.

The Application software controls this parameter.

04.10	Torque Offset Enable
Coding	Bit
Units:	N/a
Default settings:	0

When this parameter is set, winder compensation for losses and inertia is enabled.

04.11	Torque Mode Selector
Coding	RW, Uni
Range:	0 to 4
Default settings:	0

Closed loop

The value of this parameter refers to the switches TM0 to TM3 shown on the Menu 4 diagram. Only one of the switches can be closed at a time.

- 0 Speed control mode
- 1 Torque control
- 2 Torque control with speed override
- 3 Coiler/un-coiler mode
- 4 Speed control with torque feed-forward

The Application software controls this parameter. (selects mode 3 & 4)

04.15	Thermal Time Constant
Coding	RW, Uni
Range:	0 to 400
Units:	s
Default settings:	Vector = 89; Servo = 20

The temperature of the motor as a percentage of maximum temperature, with a constant current magnitude of I, constant value of K and constant

value of Motor Rated Current after time t is given by: -

Temp = $[I2 / (K \times \text{Motor rated current})^2] (1 - e^{-t/t}) \times 100\%$

This assumes that the maximum allowed motor temperature is produced K x Motor rated current and that t is the thermal time constant of the point in the motor that reaches it maximum allowed temperature first. t is defined by parameter 04.15. The estimated motor temperature is given by parameter 04.19 as a percentage of maximum temperature. If 04.15 is set to zero the thermal protection system is disabled. Otherwise 04.15 defines the thermal time constant, except if the parameter has a value between 0.0 and 1.0 the thermal time constant is taken as 1.0.

8.1.5 Menu 5

05.01	Motor Frequency
Coding	RO, Bi, P
Range:	0 - 1250.0
Units:	Hz

In these modes the output frequency is not controlled directly, and so the output frequency displayed in this parameter is calculated by measuring the frequency of the controller reference frame.

05.02	Motor Voltage
Coding	RO, Bi, P
Range:	0 – Max Supply Voltage
Units:	Volts

This Indicates the Motor terminal voltage.

05.03	Motor Power
Coding	RO, Bi, P
Range:	+/- Max Drive power
Units:	kW

This Indicates the Motor Power.

05.04	Motor Speed
Coding	RO, Bi, P
Range:	+/- 120,000
Units:	r/min

The motor r/min is calculated from the post ramp reference.

05.05	DC Bus Voltage
Coding	RO, Uni, P
Range:	0 - DC max voltage
Units:	Volts

Voltage across the internal D.C. link of the drive

05.06	Motor rated Frequency
Coding	RW, Uni
Range:	0 to 1000
Units:	Hz
Default settings:	Eur = 50.0 : USA = 60.0

The motor nameplate rated frequency.

05.07	Motor rated Current
Coding	RW, Uni
Range:	0 to Drive Rating
Units:	Amps
Default settings:	Drive Rating

The motor nameplate rated Current.

05.08	Motor rated Full load r/min
Coding	RW, Uni
Range:	0 to 40,000
Units:	r/min
Default settings:	0

05.09	Motor rated Voltage
Coding	RW, Uni
Range:	0 to Max AC Supply
Units:	Volts
Default settings:	Eur = 400 : USA = 460

The motor nameplate rated Voltage.

05.10	Motor rated Power Factor
Coding	RW, Uni, S, P
Range:	0 to 1.000
Default settings:	0.850

The motor nameplate rated Power factor. This automatically set when an auto-tune is performed. When set manually it is suggested that the motor nameplate value divided by 0.95 is used to allow for the effect of motor leakage inductance.

This is necessary because the Unidrive-SP power factor parameter represents $\cos(i_{torque}/i_{rated})$ whereas the motor manufacturer defines the power factor as $\cos(i_{real}/i_{rated})$ where i_{real} is the in phase component of current.

Winders operating in Torque mode above motor base speed require accurate control of motor torque, an indication of the accuracy of this function and hence the validity of the motor map parameters, may be assessed by checking the values of 4.02 (active current) and 4.17 (magnetising current) throughout the speed range.

In the constant torque area 4.02 should vary in relation to tension set point and diameter (Total torque) whilst 4.17 (Magnetising current) should remain constant. When the constant power region is reached 4.17 should reduce weakening the flux as the speed is increased and 4.02 should show a related increase in value to compensate for the reduction in flux.

05.11	Number of Motor poles
Coding	RW, Txt, P
Range:	2 –32
Units:	poles
Default settings:	4

Set to the no. of poles for the motor being used.

05.12	Magnetising Current test Enable
Coding	RW, Bit, P
Default settings:	0

Closed Loop Vector

1. Stationary test

The stationary test measures the stator resistance (05.17) and transient inductance (05.24). When this test is complete the current loop gains (04.13 and 04.14) are overwritten with the correct values based on the calculations given in Menu 4. The a moderately accurate value of j1 as described in menu 4 can be obtained to set the correct current limits and flux level in the motor.

2. Rotating test

A stationary test is performed to measure stator resistance (05.17) and transient inductance (05.24). This is followed by a rotating test in which the motor is accelerated with the currently selected ramps to 2/3 of rated speed and held at this speed for up to 30 seconds. During the rotating test the stator inductance (05.25), and the motor saturation breakpoints (05.29 and 05.30) are modified by the drive. The power factor is also modified for user information only, but is not used after this point because the stator inductance will have a non-zero value. When the test is complete the motor coasts to a stop. The motor should be unloaded for this test to produce correct results. When this test is complete the current loop gains (04.13 and 04.14) are overwritten with the correct values based on the calculations given in Menu 4.

3. Inertia measurement

The motor speed changes from 1/3 to 2/3 rated speed in the forward direction several times with no ramps (i.e. under current limit) to measure the motor and load inertia. The motor can be loaded with a constant torque load and still give an accurate result, however, non-linear loads and loads that change with speed will cause measurement errors.

Servo

1. Low speed test

The motor is rotated slowly by up to 3 turns first in the forward direction and then in the reverse direction. The drive applies rated current to the motor during the test. During this test the encoder phase angle (03.25), stator resistance (05.17) and transient inductance (05.24) parameters are overwritten. The motor may be loaded during this test, but the load should not exceed the rated torque of the motor and should be the same in both directions. During this test the current loop gains (04.13 and 04.14) are overwritten with the correct values based on the calculations given in Menu 4.

2. Inertia measurement

The motor speed changes from 1/3 to 2/3 rated speed in the forward direction several times with no ramps (i.e. under current limit) to measure the motor and load inertia. The motor can be loaded with a constant torque load and still give an accurate result, however, non-linear loads and loads that change with speed will cause measurement errors.

The auto-tune tests may be aborted at any time by pressing the stop key on the drive or de-activating the drive enable.

05.18	Switching Frequency
Coding	RW, Txt
Range:	3- 16
Units:	kHz
Default settings:	Vector = 3; Servo = 6

This defines the PWM switching frequency, selection range: 3kHz, 4kHz, 6kHz, 8kHz, 12kHz & 16kHz.

8.1.6 Menu 6

06.01	Stop mode selector
Coding	RW, Txt
Range:	0 - 2
Default settings:	1

Defines the type of stopping mode when the run signal is removed.

0 Coast inhibits the invertor

1 Ramp Stop with ramp

2 No ramp Stop with no ramp

Application Recommended setting = 1

06.04	Start/Stop Logic Select
Coding	RW, Uni, P
Range:	0 - 4
Default settings:	4

This parameter is provided to allow the user to select several predefined digital input routing macros to control the sequencer. When a value between 0 and 3 is selected the drive processor continuously updates the destination parameters for digital I/O F2, F3 and F4, and to the enable sequencer latching bit (06.40). When a value of 4 is selected the destination parameters for these digital I/O and parameter 06.40 can be modified by the user.

NOTE Any changes made to the destination parameters only become active after a drive reset.

The Application software controls this parameter, (setting of 4) and all sequencing bits (06.30, 06.31, 06.32).

06.08	Hold Zero Speed
Coding	RW, bit
Default settings:	Vector = 0; Servo = 1

When this bit is set the drive remains active even when the run command has been removed and the motor has reached standstill. The drive goes to the 'StoP' state instead of the 'rdy' state.

06.15	Drive enable
Coding	RW, bit
Default settings:	1

Setting this parameter to 0 will disable the drive. It must be at 1 for the drive to run.

The Application software controls this parameter.

8.1.7 Menu 7

07.01	Terminal 5 & 6 - Analogue Input 1 Value
Coding	RO
Range	±100.00

07.02	Terminal 7 - Analogue Input 2 Value
Coding	RO
Range	±100.00

07.03	Terminal 8 - Analogue Input 3 Value
Coding	RO
Range	±100.00

These parameters should be used to configure the users selection of analogue I/O. In most instances it should only be necessary to enter address pointer data. Offsets and scale factors should normally be left at default.

07.07	Analog Input 1 Offset trim
Coding	RW, Txt
Range	±10.000
Default settings:	0

Trims any offset in the reference signal

Application recommended setting 0.

07.08	Analog Input 1 Scaling
Coding	RW, Uni
Range	0.000 – 4.000
Default settings:	1.000

Allows scaling of analogue signals, should not be necessary

Application recommended setting1.000.

07.09	Analog Input 1 Invert
Coding	RW, Bit
Range	0-1
Default settings:	0

Inverts the polarity of the analogue signal.

Application recommended setting 0.

07.10	Analog Input 1 destination address
Coding	RW, Uni
Range	0.00 – 20.50
Default settings:	1.36

Sets the parameter, which the analogue input, is to control. Modifications are only accepted after a reset.

Application recommended setting:

1925 Line Speed Ref.

07.11	Analog Input 2 Mode selector
Coding	RW, Txt
Default settings:	0

Determines the type of signal to be handled

Application recommended setting 0.

07.12	Analog Input 2 Scaling
Coding	RW, Uni
Range	0.000 – 4.000
Default settings:	1.000

Allows scaling of analogue signals, should not be necessary

Application recommended setting 1.000.

07.13	Analog Input 2 Invert
Coding	RW, Bit
Range	0-1
Default settings:	0

Inverts the polarity of the analogue signal.

Application recommended setting 0.

07.14	Analog Input 2 destination address
Coding	RW, Uni
Range	0.00 – 20.50
Default settings:	0

Sets the parameter, which the analogue input, is to control. Modifications are only accepted after a reset.

Application recommended setting:

Torque Mode 1921 Tension ref

Speed Mode 1924 Dancer F/B

07.15	Analog Input 3 Mode selector
Coding	RW, Txt
Default settings:	0

Determines the type of signal to be handled

Application recommended setting 0.

07.16	Analog Input 3 Scaling
Coding	RW, Uni
Range	0.000 – 4.000
Default settings:	1.000

Allows scaling of analogue signals, should not be necessary

Application recommended setting 1.000.

07.17	Analog Input 3 Invert
Coding	RW, Bit
Range	0-1
Default settings:	0

Inverts the polarity of the analogue signal.

Application recommended setting 0.

07.18	Analog Input 3 destination address
Coding	RW, Uni
Range	0.00 – 20.50
Default settings:	0

Sets the parameter, which the analogue input, is to control. Modifications are only accepted after a reset.

Application recommended setting:

Torque Mode 1922 Taper ref

07.19	Analog Output 1 source parameter
Coding	RW, Uni
Range	0.00 – 20.50
Default settings:	3.02

Sets the parameter, which is to be output. Modifications are only accepted after a reset.

07.20	Analog Output 1 scaling
Coding	RW, Uni
Range	0.000 – 4.000
Default settings:	1.000

Scales the analog output with respect to the parameter value.

07.21	Analog Output 1 mode selector
Coding	RW, Txt
Range	0 - 2
Default settings:	VOLT

Determines the type of signal produced by the analogue output.

1 VOLt

2 0 – 20

3 4 – 20

07.22	Analog Output 2 source parameter
Coding	RW, Uni
Range	0.00 – 20.50
Default settings:	4.02

Sets the parameter, which is to be output. Modifications are only accepted after a reset.

07.23	Analog Output 2 scaling
Coding	RW, Uni
Range	0.000 – 4.000
Default settings:	1.000

Scales the analog output with respect to the parameter value.

07.24	Analog Output 2 mode selector
Coding	RW, Txt
Range	0 - 2
Default settings:	VOLT

Determines the type of signal produced by the analogue output.

4 VOLt

5 0 – 20

6 4 – 20

For details of other Menu 7 analogue configuration parameters see the Unidrive-SP Manual.

8.1.8 Menu 8

The following parameters may be used to monitor and configure the digital control functions. Settings will depend upon the desired functionality of the particular installation.

08.01	Terminal 24 Digital I/O State indicator
Coding	RO, Bit
Range	0 - 1

08.02	Terminal 25 Digital I/O State indicator
Coding	RO, Bit
Range	0 - 1

08.03	Terminal 26 Digital I/O State indicator
Coding	RO, Bit
Range	0 - 1

08.04	Terminal 27 Digital I/O State indicator
Coding	RO, Bit
Range	0 - 1

08.05	Terminal 28 Digital I/O State indicator
Coding	RO, Bit
Range	0 - 1

08.06	Terminal 29 Digital I/O State indicator
Coding	RO, Bit
Range	0 - 1

08.07	Terminal 41 & 42 Status Relay indicator
Coding	RO, Bit
Range	0 - 1

08.09	Terminal 31 Enable I/P State
Coding	RO, Bit
Range	0 - 1

08.10	Enable mode select
Coding	RO, Bit
Range	0 - 1

Application recommended setting 1.

8.21	Terminal 24 destination or source parameter
Coding	RW, Uni
Range	0.00 – 20.50
Default setting:	10.03 (At Zero Speed)

8.11	Terminal 24 invert
Coding	RW, Bit
Range	0 - 1
Default setting:	0

08.31	Terminal 24 output enable
Coding	RW, Bit
Range	0 - 1
Default setting:	1

08.22	Terminal 25 destination or source parameter
Coding	RW, Uni
Range	0.00 – 20.50
Default setting:	10.33 (Reset)

08.12	Terminal 25 invert
Coding	RW, Bit
Range	0 - 1
Default setting:	0

08.32	Terminal 25 output enable
Coding	RW, Bit
Range	0 - 1
Default setting:	1

08.23	Terminal 26 destination or source parameter
Coding	RW, Uni
Range	0.00 – 20.50
Default setting:	06.30 (Run Forward)

This Parameter should be set to another parameter destination other than the Default. Parameter 06.30 is set within the Winder Program, using this default setting will cause in-correct operation of the winder.

08.13	Terminal 26 invert
Coding	RW, Bit
Range	0 - 1
Default setting:	0

08.33	Terminal 26 output enable
Coding	RW, Bit
Range	0 - 1
Default setting:	1

08.24	Terminal 27 destination or source parameter
Coding	RW, Uni
Range	0.00 – 20.50
Default setting:	06.32 (Run Reverse)

This Parameter should be set to another parameter destination other than the Default. Parameter 06.32 is set within the Winder Program, using this default setting will cause in-correct operation of the winder.

08.14	Terminal 27 invert
Coding	RW, Bit
Range	0 - 1
Default setting:	0

08.25	Terminal 28 destination or source parameter
Coding	RW, Uni
Range	0.00 – 20.50
Default setting:	01.41 (Analogue ref. 2 select)

08.15	Terminal 28 invert
Coding	RW, Bit
Range	0 - 1
Default setting:	0

08.26	Terminal 29 destination or source parameter
Coding	RW, Uni
Range	0.00 – 20.50
Default setting:	06.31 (Jog)

This Parameter should be set to another parameter destination other than the Default. Parameter 06.31 is set within the Winder Program, using this default setting will cause in-correct operation of the winder.

08.16	Terminal 29 invert
Coding	RW, Bit
Range	0 - 1
Default setting:	0

08.27	Relay source parameter
Coding	RW, Uni
Range	0.00 – 20.50
Default setting:	10.01 (Drive Healthy)

08.17	Relay invert
Coding	RW, Bit
Range	0 - 1
Default setting:	0

08.29	Positive logic select
Coding	RW, Bit
Range	0 - 1
Default setting:	0

08.30	Open collector outputs select
Coding	RW, Bit
Range	0 - 1
Default setting:	0

Allows outputs to be wired in parallel.

8.1.9 Menu 11

11.23	Serial comms. address
Coding	RW, Uni
Range:	0 - 247
Default settings:	1

Used to define the unique address for the drive for the serial interface. The drive is always a slave.

ANSI

When the ANSI protocol is used the first digit is the group and the second digit is the address within a group. The maximum permitted group number is 9 and the maximum permitted address within a group is 9. Therefore, parameter 11.23 is limited to 99 in this mode. The value 00 is used to globally address all slaves on the system, and x0 is used to address all slaves of group x, therefore these addresses should not be set in this parameter.

Modbus RTU

When the Modbus RTU protocol is used addresses between 0 and 247 are permitted. Address 0 is used to globally address all slaves, and so this address should not be set in this parameter.

11.24	Serial comms. mode selector
Coding	RW, Txt, R, P
Range:	0 - 1
Default settings:	1

This parameter defines the communications protocol used by the 485 comms port on the drive. This parameter can be changed via the drive keypad, via an option module or via the comms interface itself. If it is changed via the comms interface, the response to the command uses the original protocol. The master should wait at least 20ms before send a new message using the new protocol. (Note: ANSI uses 7 data bits, 1 stop bit and even parity; Modbus RTU uses 8 data bits, 2 stops bits and no parity.)

Parameter value String Comms mode:

0 = AnSI ANSIx3.28 protocol

1 = rtU Modbus RTU protocol

Application Recommended setting = 1

11.25	Serial comms. baud rate selector
Coding	RW, Txt, P
Range:	0 - 9
Default settings:	6 (19200)

Used in all comms modes to define the baud rate.

This parameter can be changed via the drive keypad, via an option module or via the comms interface itself. If it is changed via the comms interface, the response to the command uses the original baud rate. The master should wait at least 20ms before send a new message using the new baud rate.

Parameter value String/baud rate:

0 = 300
1 = 600
2 = 1200
3 = 2400
4 = 4800
5 = 9600
6 = 19200
7 = 38400
8* = 57600
9* = 115200
*Modbus RTU only

11.26	Minimum Comms Transmit Delay
Coding	RW, Uni
Range:	0 to 250
Units:	ms
Default settings:	2

There will always be a finite delay between the end of a message from the host (master) and the time at which the host is ready to receive the response from the drive (slave). The drive does not respond until at least 1ms after the message has been received from the host allowing 1ms for the host to change from transmit to receive mode. This delay can be extended using parameter 11.26 if required for both ANSI and Modbus RTU protocols.

8.1.10 Menus 15, 16 & 17

These are used for the SM-option module set up parameters and are allocated depending on the Slot the SM option module is fitted, (refer to section *Slot Menus* on page 17). For Further information on SM-option module set ip menus please refer to the relevant manual, detailed below.

Manual Description	CT Part Number
SM-DeviceNet	0471-0009
SM-PROFIBUS-DP	0471-0008
SM-Applications	0471-0007
SM-I/O Plus	0471-0006
SM-Universal Encoder Plus	0471-0005

8.2 Application Parameters

8.2.1 Menu 18

18.01	Actual Diameter	
Coding	RO, U	
Range:	Min and Max diameter [18.16-18.17]	
Units:	Millimetres	0.1inches

Indicates the current diameter.

18.02	Preset Diameter	
Coding	RO, U	
Range:	Min and Max diameter [18.16-18.17]	
Units:	Millimetres	0.1inches

Displays the value of the diameter to be used as the preset value.

18.03	Percentage Final Tension Demand
Coding	RO, U
Range:	0 - 32000
Units:	0 – 10 volts on analogue output

Indicates the required level of tension demanded by the system after taper tension has been applied as a per unit value. This value may be output via an analogue channel to set the loading of a dancer system, possibly in conjunction with an E/P converter.

18.04	Line Speed Indication for MMI	
Coding	RO, U	
Range:	0 – Max m/min [18.29]	
Units:	0.1m/min	0.1ft/min

Displays the actual line speed in Engineering Units.

18.05	Winder Speed
Coding	RO, B
Range:	+/– 32767
Units:	r/min

Indicates the actual speed of the winder shaft.

18.06	Motor Speed	
Coding	RO, B	
Range:	+/– 32767	
Units:	r/min	

Indicates the speed of the winder motor, may be used in the master drive to limit line speeds where there are limitations on winder.

18.07	Tension Feedback in EGUs	
Coding	RO, U	
Range:	0 – 18.30	
Units:	Newtons	lbf

Displays the actual Tension as measured by a load cell in Engineering Units.

18.08	Actual Tension Set Point	
Coding	RO, U	
Range:	0 – 32767	
Units:	Newtons	lbf

Indicates the value of the final tension reference after taper has been applied. The data is taken from the output of the tension reference ramp and relates directly to the tension to be produced by the winder. This signal is intended for use when tension feed forward torque compensation is required in the speed controlled master drive a technique used on high performance high-speed winders. The value is provided in Newtons.

18.09	Diameter Hold Flag
Coding	RO, Bit

This is set to 1 when the diameter calculator is being held.

18.10	Not allocated
Coding	RO, U
Range:	0 - 32767
Units:	

This parameter has not been used.

18.11	Diameter Hold Threshold
Coding	RW, U
Range:	1 - 32767
Units:	r/min

This parameter determines the speed of the winder shaft below which the diameter calculator is frozen. This parameter is only applicable when calculating the diameter from line speed (m/min) / winder speed (r/min), (18.44=0).

18.12	Speed Offset	
Coding	RW, U	
Range:	0 – 32767	
Units:	m/min	ft/min

Sets the offset speed used when the Unidrive-SP operates in Torque modes (18.32=0).

18.13	Stall Tension Set Point
Coding	RW, U
Range:	0 –100
Units:	Percentage

Determines the level of tension demanded under stall tension. Can be set as a percentage of the Tension Set Point or Maximum Tension. See parameter 18.34.

18.14	PID P Gain
Coding	RW, U
Range:	0 - 32767
Units:	0.001Kp

Sets the gain of the P term when using the PID to provide closed loop tension control. A value of 1000 gives unity gain.

18.15	PID Integral Gain
Coding	RW, U
Range:	0 - 32767
Units:	0.1Ki.sec

Sets the gain of the I term when using the PID to provide closed loop tension control.

18.16	Minimum Diameter	
Coding	RW, U	
Range:	1 - 32767	
Units:	Millimetres	0.1inches

Sets the low limit of the diameter range should be set equal to the mandrel diameter. Where several mandrel sizes are used, set this parameter to the smallest diameter. This is only applicable when the diameter is determined from line speed (m/min) / winder speed (r/min), (18.44=0).

18.17	Maximum Diameter	
Coding	RW, U	
Range:	Min Diameter [18.16] – 32767	
Units:	Millimetres	0.1inches

Sets the maximum limit of the diameter range and should be set equal to the maximum diameter to be handled.

18.18	Material Gauge	
Coding	RW, U	
Range:	1 – 32000	
Units:	Microns	0.001inches

Used to calibrate the diameter calculator when operating in lap count mode (18.44=1). The gauge is also be used to dynamically calculate the diameter-slewing rate when the diameter is determined from line speed (m/min) / winder speed (r/min), (18.44=0).

18.19	PID D Gain
Coding	RW, U
Range:	0 - 32767
Units:	0.1Kd/sec

Sets the gain of the D term when using the PID to provide closed loop tension control.

18.20	PID Output Limit	
Coding	RW, U	
Range:	Speed Mode: 0 – 320767 Torque Mode: 0-1000	
Units:	Speed Mode: cm/min Torque Mode: 0.1%	Speed Mode: 0.01ft/min Torque Mode: 0.1%

Sets the maximum effective trim available from the PID in closed loop mode.

18.21	Motor Base Speed
Coding	RW, U
Range:	1 – 32767
Units:	r/min

Used to calibrate the winder software to the motor.

18.22	Motor Base Power	
Coding	RW, U	
Range:	1 – 32767	
Units:	0.1kWatts	0.1hp

Used to calibrate the winder software to the motor. Allows kW value to one decimal place to be entered.

18.23	Gear Ratio
Coding	RW, U
Range:	100 - 32767
Units:	0.01

Used to calibrate the winder software to the motor.

18.24	Centreing Window
Coding	RW, U
Range:	0 - 32767
Units:	None

Sets the width of the window around the target position for the dancer centreing routine. When operating with a dancer in speed mode enabling Tension On will result in the centreing routine positioning the dancer at this position before the PID control is enabled.

18.25	PID Filter
Coding	RW, U
Range:	0 - 32767
Units:	TC

Used to filter the output from the PID D term.

18.26	Material Width	
Coding	RW, U	
Range:	1 - 32767	
Units:	Millimetres	0.1inches

Set to the width of material being wound, if width variations are small then set to the maximum. If large changes in width are to be accommodated then set for each product. This value is used in calculating the inertia of the wound roll.

18.27	Material Density	
Coding	RW, U	
Range:	1 - 32767	
Units:	kg/m^3	lb/ft^3

Set to the density of the material to be wound, Used in calculating the inertia of the wound roll.

Typical Metric values are:

Paper	1200
Aluminum	2800
Mild Steel	7860
Stainless Steel	7930
Brass	8500

Values for other materials should be checked with the machine supplier or user.

In some applications the actual density of the roll may be somewhat less than the density of the material due to the entrapment of air during the winding process. This can result in reductions in effective roll density of up to 25%.

To measure the density of a roll, take the weight in kg and divide by the volume in cubic metres.

The volume may be quickly estimated by measuring the width and multiplying by the cross sectional area.

$$\mathbf{Volume} = \frac{\mathbf{Pi} * |\mathbf{OD}^2 - \mathbf{ID}^2|}{4} * \mathbf{Width}$$

All measurements are in metres.

$$\mathbf{Density} = \frac{\mathbf{Weight}}{\mathbf{Volume}}$$

Remember to subtract the weight of the mandrel when assessing total material weight.

18.28	Mandrel Inertia	
Coding	RW, U	
Range:	0 - 32767	
Units:	$kg.m^2$	$lb.ft^2$

Used in calculating the total winder inertia.

The inertia of the winder mandrel and any other rotating parts, this value should be as referred to the winder shaft. Units are in $kg.m^2$.

This value may be estimated using.

$$Inertia = \frac{PixDensityxWidthx|OD^4 - ID^4|}{32}$$

All dimensions are in metres.

Density in kgm^3.

Density relates to the material of the mandrel; mild steel, for example.

18.29	Maximum Line Speed	
Coding	RW, U	
Range:	1 - 32767	
Units:	m/min	ft/min

Used to scale the winder software.

18.30	Maximum Tension	
Coding	RW, U	
Range:	1 – 32767	
Units:	Newtons	lbf

Used to scale the winder software.

18.31	Select Dancer or Load cell operation
Coding	RW, Bit

In speed mode the tension feedback to the PID control may be from a Dancer or Load cell. Depending upon the selection the set points must be selected to suit.

Dancer control requires a position set point 18.31 = 0

Load cell control requires a tension set point 18.31 = 1

18.32	Speed Mode
Coding	RW, Bit

Selects the software to operate in either Torque or Speed Mode.

0 = Torque Mode

1 = Speed Mode

18.33	Tension On
Coding	RW, Bit

Enables the tension control functions within the software.

In Speed Mode the Centreing routine will operate before full tension control is enabled.

Tension On is normally enabled once the winder has been threaded with material.

18.34	Stall Mode
Coding	RW, Bit

Determines the tension setting to be used under stall conditions.

0 = Stall Tension set to a fixed percentage of Tension set point

1 = Stall Tension set to a fixed percentage of Maximum Tension

18.35	Direct Diameter Measurement
Coding	RW, Bit

Sets the software to read an analogue input as diameter allowing use of the winder software with a diameter transducer.

The analogue input of diameter should be routed to parameter 19.23.

18.36	Over / Under Wind
Coding	RW, Bit LOCKED WHILE THE DRIVE IS ENABLED

Selects the direction of rotation of the winder.

18.37	Stall tension control select
Coding	RW, Bit

This Selects the condition for switching from Stall to Run tension:

0 – The tension setpoint is determined by the status of the run signal (19.36):

0 – Stall Tension

1 – Run Tension

1 – The tension setpoint is determines by the sense of motion from the line speed reference. No line speed stall tension is selected, and when the line speed is greater than 0 run tension is applied.

18.38	Preset Diameter
Coding	RW, Bit

Sets the calculated diameter to the value held in parameter 19.23, only active when Tension On is not enabled.

18.39	Unwind Mode
Coding	RW, Bit LOCKED WHILE THE DRIVE IS ENABLED

Selects the software to control the winder as an Unwind.

18.40	Hyperbolic Taper select
Coding	RW, Bit

This determines the type of profile to be used when taper tension is required:

0 – Linear taper

1 – Hyperbolic taper

18.41	PID Enable
Coding	RW, Bit

Enabled PID action for closed loop tension control, in Speed Mode this signal is ANDed with a flag from the Centreing Routine preventing PID action being invoked until the dancer has been positioned.

18.42	PID Hold
Coding	RW, Bit

Holds the integral term of the PID controller.

18.43	PID Integral Reset
Coding	RW, Bit

Zeros the integral term of the PID controller.

18.44	Diameter Calculation Mode
Coding	RW, Bit

Selects the software to calculate diameter either by dividing Line speed(m/min) by Winder speed (r/min) or by counting rotations of the winder shaft and multiplying by gauge.

0 = Diameter by (m/min) / (r/min)

1 = Diameter by Count * 2 * Gauge

18.45	Diameter Calculation Error Flag
Coding	RW, Bit

Indicates that there is a transient error in the result produced by the (m/min) / (r/min) calculation.

18.46	Web Break Flag
Coding	RO, Bit

Indicates that a large mis-match in the speed of the line and the speed of the winder has occurred indicting a material breakage. This flag will stay set on detection until the winder is stopped, e.g. when the reference on parameter 1.11=0 then this flag will be reset.

18.47	Web tensioned flag
Coding	RO, Bit

Set when the dancer is within the target area after selection of tension on in speed mode. Indicates that the PID has control and the line can be started. This flag is set when load cell is used, and tension is on in speed mode.

18.48	Select Loss Profiler Compensation
Coding	RW, Bit

Selects the type of loss profile to be used:

0 – Simple fixed profile using Static friction Loss (19.15) and Viscous Friction loss (19.16) parameters.

1 – User defined loss profile, using a percentage loss look up table with respect to speed. The table co-ordinates are define in parameters 70.70-70.79 for speed and 71.70-71.79 for percentage losses respectively.

To enable the compensation to be applied to tension reference torque, parameter 04.10 must be set to 1.

This can be used in Speed and torque modes.

18.49	Watch Dog trip
Coding	RO, Bit

Indicates a loss of serial communications with an external controller if the watchdog has been enabled and no response is received within the watchdog scan time.

18.50	Select US Standard Units
Coding	RW, Bit. LOCKED WHILE THE DRIVE IS ENABLED

When set input set data and output display data is handled in US Standard units. Default uses Metric units.

8.2.2 Menu 19

19.01	Tension Torque	
Coding	RO, U	
Range:	0 - 32767	
Units:	Newtons	lbf

Indicates the value of torque output deemed to be proportional to tension.

19.02	Compensation Torque	
Coding	RO, B	
Range:	-32768 to +32767	
Units:	Newtons	lbf

Indicates the value of torque output deemed to be proportional to inertia and frictional compensation.

19.03	PID Error	
Coding	RO, B	
Range:	Speed Mode: -32768 to +32767 Torque Mode: +/-1000	
Units:	Speed Mode: PU dancer position Torque Mode: 0.1%Newtons	Speed Mode: PU dancer position Torque Mode: 0.1%Newtons

Indicates the error seen by the PID controller.

19.04	Final Speed Reference	
Coding	RO, U	
Range:	0 - 32767	
Units:	0.1m/min	0.1ft/min

This parameter indicates:

Speed Mode - The demanded speed Reference

Torque Mode - The Speed Override value

19.05	Acceleration rate	
Coding	RO, U	
Range:	0 – 32767	
Units:	m/min/s	ft/min/sec

Displays the actual acceleration rate used for inertia compensation in metres per minute per second.

19.06	PID Output	
Coding	RO, B	
Range:	0 – 18.20	
Units:	Speed Mode: cm/min Torque Mode: 0.1%	Speed Mode: 0.01ft/min Torque Mode: 0.1%

This parameter is not used.

19.07	Calculated diameter before slew limiting	
Coding	RO, U	
Range:	0 – 32767	
Units:	mm	tenths

Allows a check on the result of the calculation Line speed / Winder r/min before the slew limiter.

19.08	Actual Slew rate limit applied to diameter calculation	
Coding	RO, U	
Range:	0 – 32767	
Units:	microns/second	microns/second

Monitors the slew limit value applied to the result of the ratio diameter calculation. Will be seen to increase with winder rotational speed.

19.09	Final Tension reference	
Coding	RO, U	
Range:	0 – Max Tension [18.30]	
Units:	Newtons	

Provides a means of checking the tension reference value after the selection between Stall and Run values. Reads negative if Unwind bit is set.

19.10	Final Tension reference - pre-ramp	
Coding	RO, U	
Range:	0 – Max Tension [18.30]	
Units:	Newtons	

Monitors the tension reference value at the input to the tension ramp generator. Provides a means of checking the tension reference value after the effect of taper tension.

19.11	Preset diameter value 1	
Coding	RW, U	
Range:	Min and Max diameter [18.16-18.17]	
Units:	Millimetres	0.1inches

The new diameter to which the diameter calculator will be set on operation of parameter 18.38 is entered into this parameter. This parameter is selected as the preset value source when parameter 19.40 = 1 and 19.35 = 0. If parameter 19.40 = 0, the preset value is obtained via parameter 19.23 analogue input. The resulting value is displayed in parameter 18.02.

19.12	Preset diameter value 2	
Coding	RW, U	
Range:	Min and Max diameter [18.16-18.17]	
Units:	Millimetres	0.1inches

The new diameter to which the diameter calculator will be set on operation of parameter 18.38 is entered into this parameter. This parameter is selected as the preset value source when parameter 19.40 = 1 and 19.35 = 1. If parameter 19.40 = 0, the preset value is obtained via parameter 19.23 analogue input. The resulting value is displayed in parameter 18.02.

19.13	Diameter Slew Rate (Fixed)	
Coding	RW, U	
Range:	1 - 32767	
Units:	Microns per second	0.001inches/sec

The result produced by the diameter calculator (m/min) / (r/min) when selected (18.44=0), can be noisy resulting in transient fluctuations of torque an effective method of reducing this noise is to limit the rate of change of this signal. Slewing rate limit can either be calculated dynamically by the software using the material gauge or set at a pre-determined value as selected by parameter 19.32.

This parameter sets the slew rate for the fixed option.

19.14	Threading Speed	
Coding	RW, U	
Range:	0 – Max m/min [18.29]	
Units:	m/min	ft/min

This parameter sets the speed at which the winder will run during inching. Values are entered in m/min and the system will produce a value of r/min corrected for diameter. It is essential therefore that the diameter is initialised to the correct value before the inch function is used. Setting Inch forward parameter 19.34, or Inch reverse parameter 19.33 enables inching when tension is off.

19.15	Friction Compensation (Static)
Coding	RW, U
Range:	0 - 1000
Units:	0.1%

This parameter sets the percentage of maximum motor torque to overcome static friction. Range 0 – 1000 allows resolution of 0.1%.

Only applicable when the compensation is selected, (18.48 = 1).

19.16	Friction Compensation (Viscous)
Coding	RW, U
Range:	0 - 1000
Units:	0.1%

This parameter sets the percentage of maximum motor torque produced at maximum speed to overcome viscous friction. Range 0-1000 allows resolution of 0.1%.

Only applicable when the compensation is selected, (18.48 = 1).

19.17	Taper Start Diameter	
Coding	RW, U	
Range:	Min and Max diameter [18.16-18.17]	
Units:	Millimetres	0.1inches

Determines the diameter reached before taper tension is applied, set to minimum diameter as default.

19.18	Tension Slew Time
Coding	RW, U
Range:	1 - 32767
Units:	0.1Seconds

This parameter sets the ramp time applied to the tension set point. Ramping the tension reference prevents shock transients being applied to the material when operator tension changes are made.

19.19	Motor Inertia	
Coding	RW, U	
Range:	0 - 32767	
Units:	$Kg.m^2$	$lb.ft^2$

Used in calculating the total inertia.

19.20	Dancer Position Set Point
Coding	RW, U
Range:	0 - 32767
Units:	Per Unit

This parameter sets the target position for the dancer when operating in Speed Mode.

19.21	Tension Set Point (Analogue)
Coding	RW, U
Range:	0 - 32767
Units:	Per Unit

This parameter provides the tension set point when using an analogue input; it is scaled internally by the value in parameter 18.30 to produce an internal value in Newtons. For digital set point see parameter 19.38.

19.22	Taper Set Point (Analogue)
Coding	RW, U
Range:	0 - 32767
Units:	Per Unit

This parameter provides the taper set point when using an analogue input. The value is internally scaled to 0 – 100%. For digital set point see parameter 19.39.

19.23	Preset Diameter
Coding	RW, U
Range:	1 - 32767
Units:	Per Unit

Set to the required start diameter in analogue units. E.g. 32000 is equal to maximum diameter. Use where analogue input of start diameter is required. The value is internally scaled to 0 to Maximum diameter parameter 18.17.

For digital Preset set point and internal derived diameter calculation see parameters 18.35 & 18.44.

19.24	Load Cell / Dancer Feed Back
Coding	RW, U
Range:	0 – 32767
Units:	Per Unit

The analogue input used for tension feedback should be routed to this parameter.

19.25	Line Speed Reference (Analogue)	
Coding	RW, U	
Range:	0 – 32767	
Units:	Per Unit	

This parameter provides the line speed set point when using an analogue input. When using an analogue line speed reference signal, the software will determine acceleration rates. See parameters 19.31 and 20.23.

Due to its predefined internal scaling it should only be assigned to analogue input channel 1, terminals 5 & 6.

19.26	Tension Set Point (Digital)	
Coding	RW, U	
Range:	0 – Max Tension [18.30]	
Units:	Newtons	lbf

Allows direct input of Tension Set Point from a terminal or similar device in Engineering Units. For analogue set point see parameter 19.38.

19.27	Taper Set Point (Digital)	
Coding	RW, U	
Range:	0 – 100	
Units:	Percent	

Allows direct input of Taper Set Point from a terminal or similar device in percentage reduction at maximum diameter. For analogue set point see parameter 19.39.

19.28	Centreing Acceleration	
Coding	RW, U	
Range:	0 - 32767	
Units:	cm/min/s	ins/min/sec

This defines the acceleration rate used for the centreing speed. Ensure this value is not set too small as oscillation may occur if centring window (18.24) is set too narrow.

19.29	Centreing Speed	
Coding	RW, U	
Range:	0 – Max m/min [18.29] * 100	
Units:	metres per minute	Feet per min

This parameter sets the maximum speed at which centreing routine will be performed.

19.30	Slip Factor
Coding	RW, U
Range:	100 – 2000
Units:	0.001%

The line speed reference signal is multiplied by this parameter and divided by 1000. Allowing a slip factor to be introduced to compensate for differences between nip speed and material speed at the master drive.

19.31	Select Digital Line Speed Input
Coding	RW, Bit

This parameter when set causes the software to obtain the line speed and acceleration references from registers 73.01 and 73.02. These parameters values are intended to be set via fieldbus serial communication and have been purposely define to these registers so the values can be easy derived with CTNet using the cyclic channels. The speed and acceleration data should be presented as follows:

73.01 = Speed reference (0 – 16000 equivalent to 0 – Max Speed)

73.02 = Acceleration rate (16000 equivalent to 0 – Max Speed in 1 Second)

When this parameter is not set then the line speed reference will be obtained from the analogue source parameter 19.25 and the acceleration rate will be obtained from the differential of this value.

19.32	Select Fixed Diameter Slew Limit
Coding	RW, Bit

This parameter when set causes the software to use the slew rate set in parameter 19.13, when not set the slew rate will be calculated from gauge and revolutions per second. Giving a limit value, which is automatically adjusted for line speed and diameter.

This parameter is only applicable when calculating the diameter from line speed (m/min) / winder speed (r/min), (18.44=0).

19.33	Inch Reverse Command Bit
Coding	RW, Bit

Setting this bit will cause the drive to run at thread speed in reverse direction.

Inch is only active when not in tension mode (18.33=0) and any other command is inactive (19.34 = 0 or 19.36=0).

19.34	Inch Forward Command Bit
Coding	RW, Bit

Setting this bit will cause the drive to run at thread speed in forward direction.

Inch is only active when not in tension mode (18.33=0) and any other command is inactive (19.33 = 0 or 19.36=0).

19.35	Select second preset diameter
Coding	RW, Bit

Selects 19.12 as the value used to preset diameter when 18.38 is activated.

19.36	Run Forward Command Bit
Coding	RW, Bit

Setting this bit will cause the drive to run I n the forward direction.

Speed reference is derived from the Line speed.

Run is only active when tension is off (18.33 = 0)

19.37	Manual Diameter Hold Bit
Coding	RW, Bit

Setting this bit will freeze the diameter calculator (m/min) / (r/min) function. This action is internally ORed with several other conditions, which monitor winder r/min, Dancer positioned, Slew rate and Tension Not On. It applies to both diameter calculation modes, Speed Ratio & Lap count.

19.38	Select Tension Set Point from Digital Source
Coding	RW, Bit

Setting this bit will cause the software to obtain the tension set point from parameter 19.26. Data should be passed to parameter 19.26 in Newtons from a suitable digital source, MMI or PLC using serial communications access.

When set to 0, the tension set point is derived from an analogue source to parameter 19.21.

19.39	Select Taper Set Point from Digital Source
Coding	RW, Bit

Setting this bit will cause the software to obtain the tension set point from parameter 19.27. Data should be passed to parameter 19.27 in per unit format from a suitable digital source, MMI or PLC using serial communications access. The percentage taper set will occur at maximum diameter.

When set to 0, the Taper set point is derived from an analogue source to parameter 19.22.

19.40	Select Diameter Set Point from Digital Source
Coding	RW, Bit

Setting this bit will cause the software to obtain the tension set point from parameter 18.07. Data should be passed to parameter 18.07 in Millimetres from a suitable digital source, MMI or PLC using serial communications access. This value will then be used during the diameter preset routine instead of parameter 19.23.

When set to 0, the Diameter set point is derived from an analogue source to parameter 19.23.

19.41	Lap count reversal
Coding	RW, Bit

Reverses the direction of the diameter change when lap or traverse mode are selected. Provides compensation for differences between winder shaft and motor directions of rotation. Winder diameters should increment and Unwind diameters should decrement.

19.42	End of traverse limit switch input (Traverse mode)
Coding	RW, Bit

Signals a change in direction of the traverse mechanism calling for the diameter to be increased by another layer.

19.43	Select traverse mode
Coding	RW, Bit

Modifies the lap counting function to operate in traverse mode incrementing diameter whenever a positive edge is detected on parameter 19.42.

19.44	Watch dog enable

Enables the watchdog monitor, which checks for continuity of the serial communication with an external controller or MMI.

19.45	Acceleration signal selection
Coding	RW, Bit

Allows a choice between an internally generated an externally provided value of acceleration rate for use by the Inertia compensation routine. When parameter 19.45 = 0 the inertia compensation calculation is performed, using a signal produced by differentiating the line speed reference. The differential sample time can be adjusted by parameter 20.23.

When parameter 19.45 = 1, the acceleration signal is read from a register, which is derived via serial communications from an external source.

19.46	Indicates direction of line speed reference
Coding	RO, Bit

This parameter monitors the polarity of the line speed reference.

0 – Forward Line direction

1 – Reverse Line direction

19.47	Select Torque Memory mode

When activated causes the winder to change from speed control to a memorised average level of torque measured during the period just prior to activation. In torque mode holds the current value of tension torque. Allows the winder to continue operation without the intervention of the load cell or dancer during turret changeovers. Should be de-activated immediately the roll transfer has been completed.

19.48	Enable Lay On Roll tension boost
Coding	RW, Bit

When activated the tension set point is increased by the value in 20.25.

19.49	Enable Index Tension boost
Coding	RW, Bit

When activated the tension set point is increased by the value in 20.24.

19.50	Enable Speed Boost
Coding	RW, Bit

When activated the value in 20.26 is added to the line speed reference, can be used to modify the winder speed during turret changeovers.

8.2.3 Menu 20

20.20	Watchdog Clock time
Coding	RW, U
Range:	1 – 32767
Units:	0.01 seconds

The time set is half the symmetrical clock time and is used for the Drives communications heartbeat to the remote device (PLC, HMI etc).

20.21	Watchdog Trip Delay
Coding	RW, U
Range:	1 – 32767
Units:	0.1 seconds

This delay defines the maximum time for the incoming heartbeat from the remote device to change state, before the watchdog trip flag (18.49), is set. This should be set according to the network traffic and update with enough margin to reduce spurious tripping.

20.22	Speed measurement time base
Coding	RW, U
Range:	10 – 10,000
Units:	Milliseconds

In order to provide the diameter calculation block with a smooth and accurate measurement of winder speed when using incremental encoder feedback. The encoder count is accumulated over an extended time base. This produces a more consistent measurement of speed than that obtained from parameter 3.02. Parameter 19.26 sets this time base and is set to default of 100 milliseconds.

20.23	Differentiator scan time
Coding	RW, U
Range:	0 - 100
Units:	Multiples of 10 milliseconds

Sets the scan time for the differentiator, which provides a measure of acceleration rate for use by the inertia compensation function. The differentiator is not used if an external rate signal is selected by parameter 19.45.

20.24	Index tension boost value
Coding	RW, U
Range:	+/-1000
Units:	Percentage of running tension 0.1%

Sets the increase in tension set point to compensate for errors during turret indexing.

20.25	Lay On tension boost value
Coding	RW, U
Range:	+/-1000
Units:	Percentage of maximum tension 0.1%

Sets the increase in tension set point to compensate for the losses during contact with the lay on roll during roll changes.

20.26	Speed boost value
Coding	RW, U
Range:	+/-10% of 18.29
Units:	% of MPM : % of ft/min

Sets the increase in line speed set point can be used to increase the incoming roll speed during splicing. Limited to 10% of maximum line speed.

20.27	Select line speed reference from encoder
Coding	RW, Bit

When set the winder will derive the line speed reference from an encoder signal. A second encoder option module must be fitted to allow this function to operate.

20.28	Not allocated
Coding	RW, Bit

20.29	Time base for line encoder speed measurement
Coding	RW, U
Range:	10 - 10000
Units:	milliseconds

In order to provide the diameter calculation block with a smooth and accurate measurement of line speed when using an incremental encoder reference. The encoder count is accumulated over an extended time base. The default is set to 100 milliseconds, increasing this time will slow the rate at which the line speed reference is updated but reduce any signal flicker, reducing the time will increase the update rate but may result in increased signal noise levels.

20.30	Line encoder RPM at maximum line speed
Coding	RW, U
Range:	0-32767
Units:	r/min

This value calibrates the internal frequency measurement to match the required line speed reference signal. The speed should be that attained by the line encoder when the machine is running at the maximum line speed as input in 18.29.

20.31	Enable Slack Web detection (Speed mode only)
Coding	RW, Bit

When set to 1 the software will attempt to detect a slack web by monitoring the Dancer or Lad cell feed back signal level compared with 20.32

20.32	Slack Web detection threshold
Coding	RW, U
Range:	0 - 1000
Units:	0.1 percent

If the Dancer or Load Cell feed back level falls below this value the software will assume that the web is out of control.

20.33	Diameter acquire multiplier factor
Coding	RW, U
Range:	1 - 1000
Units:	Per Unit

The factor by which the diameter slew rate will be multiplied when the acquire function is activated.

20.34	Enable Acquire on start up (Speed mode only)
Coding	RW, Bit

When set to 1 the software will multiply the diameter slewing rate by the value in 20.33. for 10 seconds after every start up from a tension off condition.

20.35	Enable Acquire (Speed mode only)
Coding	RW, Bit

When set to 1 the software will multiply the diameter slew rate by the value in 20.33 for the duration of the controlling signal up to a limit of 10 seconds at which point it will be removed by an internal timer.

20.36	Slew lower threshold to activate hold diameter
Coding	RW, U
Range:	0 - 32767
Units:	μm/s *(0.001ins/s)*

The result produced by the diameter calculator in ratio mode will be inconsistent at low speeds. To avoid problems the diameter result is held at low speeds and low slew rates. 20.36 sets the lower limit on slew rate below which the diameter hold function will be activated. Default value is 200.

20.37	Start speed for PID gain profiler
Coding	RW, U
Range:	0 - 100
Units:	Percent of maximum speed

When operating in Speed Mode the gain of the PID is profiled against line speed. 20.37 allows the lower limit of this profiler to be adjusted, hence limiting the reduction in gain at lower speeds ensuring adequate control margin from the PID is available.

Default is set at 10% gain range of 10:1 over the line speed range.

20.38	Preset length count
Coding	RW, Bit

Resets the material length count in 70.19 to zero.

20.39	Application Software Version
Coding	R0, U

This indicates the current duty assist application software version used within the application module.

The parameter version is displayed as an integer value for example, 10208 denotes V01.02.08.

20.40	Coupling Speed Reference	
Coding	RW, U	
Range:	0 – 10	
Units:	r/min	r/min

Speed reference used to run the drive when coupling is enabled (15.37 = 1). Allows the winder to rotate at a fixed rotational speed independent of diameter whilst the splines are aligned. See 70.41 for Coupling current limit.

8.2.4 Menu 70 - 73

Certain P registers are used where immediate keypad access is not deemed important, unless a LCD keypad is used (SM-Keypad Plus).

.When using local communications connection on SM-Application module (e.g .RS485 or CTNet), these parameter can access directly, (e.g. _RXX% (or 72.XX) and _Sxx% (or 73.XX) register. When trying to access these parameter s from another SM option module (fieldbus, another SM-Application module) or the Unidirive-SP RS485 port then the routing address menu must be used. Please refer to the Unidrive-SP SM-option modules manual for more information.

Menu 70

70.19	**Length of material wound**	
Coding	RW, U	
Range:	$0 – 2^{32}$	
Units:	Metres : feet	

Accumulates the length of material measured using the line encoder signal. Can be reset to zero by activating 20.38.

70.41	**Coupling Current Limit Value**	
Coding	RW, U	
Range:	0 – 1000	
Units:	%	%

Sets a reduced current limit whilst the coupling function is enabled.

70.42	**At Line Speed acceptance window Value**	
Coding	RW, U	
Range:	0 – Max MPM / FPM	
Units:	0.1 mpm	0.1 fpm

Sets the acceptance band of the check on peripheral speed equal to line speed for splicing applications. When speed match condition is satisfied bit 11 of the Status Word will be set.

70.43	**CTNET Output Data Select**
Coding	RW, B
Range:	-1 to 255

Set -1 to broadcast data to all CTNet nodes on the network.

Set >0 to specific node address for the CTNet to transmitted to.

Set to 0 disables this function.

Winder Parameter	Description	Target Node Receiving registers
72.70	Statusword 1	73.70
72.71	Statusword 2	73.71
71.06	Actual Tension/Dancer Feedback	73.72
71.01	Actual Diameter	73.73
71.07	Tension Feed-forward	73.74

70.55	Loss Profiler Pointer
Coding	RO, U
Range:	0 – 10

This indicates the position within the loss table, which is currently being used.

70.57	Analogue diameter signal min. value	
Coding	RW, U	
Range:	0 – [70.58]	
Units:	P.U.	

Along with parameter 70.58, this scales the analogue input signal range to match the actual diameter range. Set to the value in 19.23 at minimum diameter.

70.58	Analogue diameter signal max. value	
Coding	RW, U	
Range:	[70.57] – 32000	
Units:	P.U.	

Along with parameter 70.57, this scales the analogue input signal range to match the actual diameter range. Set to the value in 19.23 at maximum diameter.

70.60	CTNet In Mapping Parameter 1 (from _S00% (73.00)	
Coding	RW, U	
Range:	100 - 9999	
Units:	-	

This parameter details the destination parameter for the data within parameter _S00% (73.00). This is intended for CTNet networks, where additional cyclic data maybe required to be mapped into the winder software.

The required destination parameter number is entered in the following format 1911, (=19.11). 0 or a multiple of 100 will disable the mapping.

NOTE This parameter mapping is updated every 10 milliseconds for where real-time data is required to be source from another CTNet node. Care must be taken when mapping to low priority parameters, as it is important to ensure the source data remains within the range of the destination parameter.

70.61	CTNet In Mapping Parameter 2 (from _S03% (73.03)	
Coding	RW, U	
Range:	100 - 9999	
Units:	-	

This parameter details the destination parameter for the data within parameter _S03% (73.03). This is intended for CTNet networks, where additional cyclic data maybe required to be mapped into the winder software.

The required destination parameter number is entered in the following format 1911, (=19.11). 0 or a multiple of 100 will disable the mapping.

NOTE This parameter mapping is updated every 10 milliseconds for where real-time data is required to be source from another CTNet node. Care must be taken when mapping to low priority parameters, as it is important to ensure the source data remains within the range of the destination parameter.

70.62	CTNet In Mapping Parameter 3 (from _S00% (73.04)	
Coding	RW, U	
Range:	100 - 9999	
Units:	-	

This parameter details the destination parameter for the data within parameter _S04% (73.04). This is intended for CTNet networks, where additional cyclic data maybe required to be mapped into the winder software.

The required destination parameter number is entered in the following format 1911, (=19.11). 0 or a multiple of 100 will disable the mapping.

NOTE This parameter mapping is updated every 10 milliseconds for where real-time data is required to be source from another CTNet node. Care must be taken when mapping to low priority parameters, as it is important to ensure the source data remains within the range of the destination parameter.

70.63	**CTNet In Mapping Parameter 4 (from _S05% (73.05)**	
Coding	RW, U	
Range:	100 - 9999	
Units:	-	

This parameter details the destination parameter for the data within parameter _S05% (73.05). This is intended for CTNet networks, where additional cyclic data maybe required to be mapped into the winder software.

The required destination parameter number is entered in the following format 1911, (=19.11). 0 or a multiple of 100 will disable the mapping.

NOTE This parameter mapping is updated every 10 milliseconds for where real-time data is required to be source from another CTNet node. Care must be taken when mapping to low priority parameters, as it is important to ensure the source data remains within the range of the destination parameter.

70.65	**Line / Reference Encoder Source Selector**	
Coding	RW, U	
Range:	0 - 3	
Units:	-	

This parameter sets the source of the line / reference encoder (#90.43), where 0 = Drive encoder input, 1 = Slot 1, 2 = Slot 2, 3 = Slot 3.

70.66	**Feedback Encoder Source Selector**	
Coding	RW, U	
Range:	0 - 3	
Units:	-	

This parameter sets the source of the feedback encoder (#90.44), where 0 = Drive encoder input, 1 = Slot 1, 2 = Slot 2, 3 = Slot 3.

70.67	**CTNet Out Desitnation Start Register**
Coding	RW, U
Range:	0 - 75
Units:	-
Default:	70

This set the CTNet destination start register of the receiving drive for the winder CTNet output data.

70.70 - 70.79	Loss Profiler Speed Co-ordinates 0 - 9	
Coding	RW, Bipolar	
Range:	+/- Max Speed(rpm) [01.06]	
Units:	r/min	

Parameters 70.70 to 70.79 define the points on the speed axis (x0, for the loss profiler and are used with the corresponding loss percentage points defined in 71.70 to 71.79.

Only applicable when parameter 18.48 = 1

70.99	Non Volatile store for Actual Diameter	
Coding	RW, U	
Range:	$0 – 2^{32}$	
Units:	Millimetres	

Used as the diameter preset value on power.

Menu 71

71.70 – 71.79	Loss Profiler Percentage Loss Co-ordinates 0-9	
Coding	RW, Uni	
Range:	0 –1000 (0-100.0)	
Units:	%	

Parameters 70.70 to 70.79 define the points on the Percentage Loss axis (Y), for the loss profiler and are used with the corresponding loss percentage points defined in 71.70 to 71.79.

Menu 72
CTNet access is located in Menu 72

72.70	Status Word 1
Coding	RW, Bipolar
Range:	0 – 65535

Serial Communication, remote status word 1.

72.71	Status Word 2
Coding	RW, Bipolar
Range:	0 – 65535

Serial Communication, remote status word 1.

72.71	Reserved
Coding	RW, Bipolar
Range:	0 – 65535

72.71	Reserved
Coding	RW, Bipolar
Range:	0 – 65535

72.71	Reserved
Coding	RW, Bipolar
Range:	0 – 65535

Menu 73

CTNet access is located in Menu 73

73.01	Line Speed Reference
Coding	RW, Bipolar
Range:	0 – 16000
Units:	Line Speed PU

The line speed reference in standardised format to maintain optimum resolution.

0 –16000 represents 0 – Maximum Line Speed (m/min)

Internal scaling is performed to convert this to m/min based upon the value of parameter 18.29 Maximum Line Speed.

73.02	Acceleration Reference
Coding	RW, Bipolar
Range:	0 – 16000
Units:	Line acceleration PU

The line speed reference in standardised format to maintain optimum resolution.

16000 represents Maximum Line Speed (m/min) attained in 1 second

An acceleration time of 10 seconds would result in an acceleration signal of 1600. Internal scaling is performed to convert this to m/min per second based upon the value of parameter 18.29 Maximum Line Speed.

73.70	Control Word 1
Coding	RW, Bipolar
Range:	0 – 65535

Serial Communication, remote status word 1.

73.71	Control Word 2
Coding	RW, Bipolar
Range:	0 – 65535

Serial Communication, remote status word 1.

9 Advanced Features

9.1 Serial Communications

9.1.1 Control Word

Introduction

The fieldbus control word is an efficient way of remotely controlling the motion of a Drive. Due to the restriction of most fieldbus word length the control word length will be no more than 16bits, UD70/MD29 PLC register _S70% & _S71%, will be used to ensure full resolution is maintained (e.g. drive parameter limited to 32000 or 1000).

Standard_S70% (parameter 73.70)

Each bit in the fieldbus control word has a particular function, and provides a method of controlling the output functions of the Drive (RUN, JOG, TRIP, etc.) with a single data word, (16Bits).

b15	b14	b13	b12	b11	b10	b9	b8
WDin	HOLD PID	ENABL PID	PRSET DIAM	RESET PID	#13.19 IPCON	TENS ON	SAVE

b7	b6	b5	b4	b3	b2	b1	b0
TRIP	RESET	COUPLE	MASK	JOG REV	JOG FWD	RUN FWD	ENABLE

To use the fieldbus control word motion control bits (shaded), the ENABLE terminal on the drive must be closed and the MASK bit (b4) must be set.

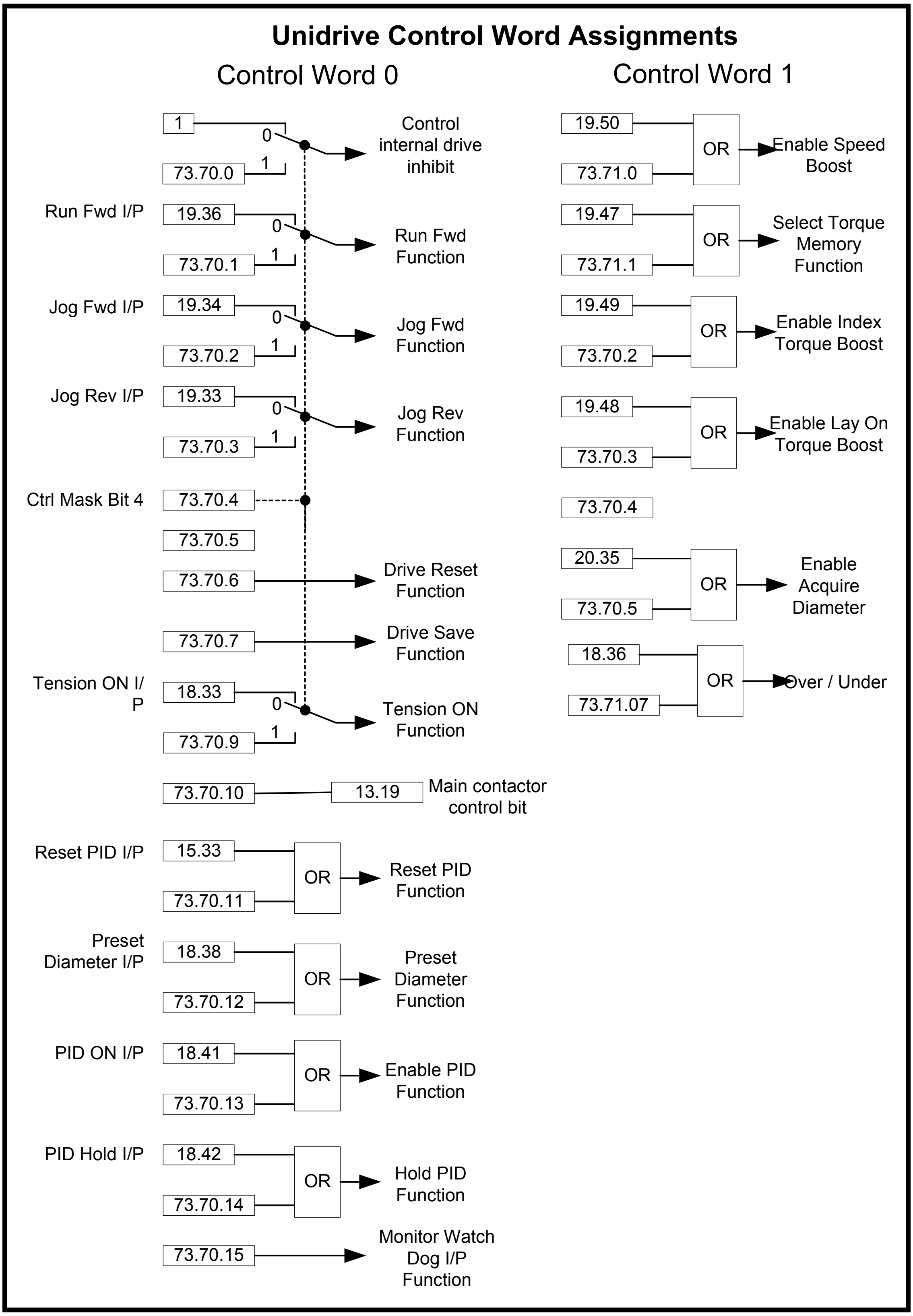
Motion bits are defined as:

Drive enable	Bit 0
Run Forward	Bit 1
Jog Forward	Bit 2
Jog Reverse	Bit 3
Tension On	Bit 9

Other functions may be operated at any time in parallel with their bit parameter equivalents.

When the MASK bit (b4) is reset to 0, motion control will be returned to the relevant bit parameters.

Overview of Control Word assignments



Control Word 1 _S71% (parameter 73.71)

Some additional functions are provide through a second control word.

b15	b14	b13	b12	b11	b10	b9	b8
							Diameter hold

b7	b6	b5	b4	b3	b2	b1	b0
	Acquire diam		MASK	Torque mem	Lay On boost	Index boost	Speed boost

These bits are used in exactly the same manner as those described above, the second control word mask bit must be set to 1 when a bit is to be set.

Control Word 0 _S70% (Parameter 73.70)

Bit	Function	Description
0	ENABLE	Must be set to 1 to put the winder in READY mode. Resetting to 0 will immediately disable the Drive, and the motor will coast to stop.
1	RUN FWD	Set to 1 (with ENABLE set to 1) to run the motor in the forward Line direction. When reset to 0, the winder will decelerate the motor to a controlled stop before the outputs disabled. This can also be used to control the tension set point, (stall and run tension refer to parameter 18.37.
2	JOG FWD	Set to 1 (with ENABLE set to 1) to jog/inch the winder motor in the forward line direction. When reset to 0, the Winder will decelerate the motor to a controlled stop before the outputs disabled
3	JOG REV	Set to 1 (with ENABLE set to 1) to jog/inch the winder motor in the reverse line direction. When reset to 0, the Winder will decelerate the motor to a controlled stop before the outputs disabled
4		The mask bit is not configured on this control word.
5	Reserved	
6	RESET	A 0-1 transition will reset the winder from any trip condition. If the cause of the trip has not been cleared, the Drive will trip again immediately.
7	TRIP	A 0-1 transition will force a “tr89” trip on the Winder. If the RESET and TRIP bits change from 0 to 1 on the same cycle, the TRIP bit will take priority.
8	SAVE	Setting to 1 will cause the current parameter settings to be saved next time the drive is disabled. The bit will then be reset automatically.
9	TENSION ON	Set to 1 to put the drive into tension control. In torque mode this will produce stall tension, in speed mode this will enable the dancer centreing routine. Once the dancer has reached target the PID tension controller will be enabled. When reset to 0, the motor will revert to speed control following the speed reference.
10	MAIN CONT	This bit writes directly to bit parameter #13.19 and is intend to be as the remote digital signal to control the Drive power contactor. This bit can be source to a digital output on the drive. **NOTE** This not to be used with digital lock. This function should be disabled when using the winder solution software
11	RESET I TERM	Set to 1 to zero the value of the PID integral term
12	PRESET DIAM	Set to 1 to preset the diameter (with TENSION ON set to 0)
13	ENABLE PID	Set to 1 to enable the action of the PID controller

14	HOLD I TERM	Set to 1 to hold the value of the PID integral term
15	WDin	Watchdog In Comms clock from remote device. Reset PID

Control Word 1 _S71% (Parameter 73.71)

Bit	Function	Description
0	SPEED BOOST	Setting to enables the Speed Boost to increase or reduce the line speed reference
1	INDEX BOOST	Setting to 1 enables the Index Torque boost
2	LAY ON BOOST	Setting to 1 enables the Lay On Torque boost
3	ENABLE TORQUE MEM	Setting to 1 puts the winder into Torque Memory mode. Only applicable when operating as a speed winder
4	MASK	0 = The winder is digital control is derived from the allocated bit parameters, (terminal configurable) 1 = The winder is digital control is derived from the control word.
5	Spare	
6	ENABLE ACQUIRE	Setting to 1 enables the diameter acquire function.
7	OVER/ UND	Setting this to 1 will select under wind.
8	Diameter hold	Setting this to 1 will hold the diameter calculator value.

When a Drive trip occurs, the Drive automatically sets the Drive control word to 0. This ensures that, for safety reasons, the Drive does not start up immediately when it is reset.

The recommended control method for the PLC program is to reset the fieldbus control word to a safe state, e.g. drive disabled, when a fault is detected in either the Application software, (The Drive control word is reset to 0 automatically when the Drive trips.) When the Serial Communication link is healthy again, the appropriate fieldbus control word can be set, a change of fieldbus control is detected, the Drive control word will be updated and the Drive will restart. Some example fieldbus control word values to control the Drive are given in the table below.

Wdin is the communication watchdog bit transmitted from remote intelligent device, (keypad or CTIU, etc).

Control Word (Hex)	Control Word (Dec)	Action
0x0000	0	Control word disabled, Drive will operate under terminal control
0x0010	16	Drive disabled
0x0011	17	Drive enabled and stopped
0x0013	19	Drive enabled and run forwards
0x0015	21	Drive enabled and Jog forwards

0x0080	128	Trip Drive
0x0040	64	Reset Drive

9.1.2 Status Word

The status word returns the status of multiple functions with the Winder system, e.g. at speed, zero speed, Drive healthy, etc., and provides a quick method of checking the current status remotely with serial communication.

Status Word1 _R70% (Parameter 72.70)

b15	b14	b13	b12	b11	b10	b9	b8
WDout	18.49			At line speed	Slack Web	Dia Hold	Max Dia

b7	b6	b5	b4	b3	b2	b1	b0
Min Dia	18.32	18.47	18.46	18.45	10.03	10.02	10.01

Bit	Parameter	Description
0	10.01	Drive healthy
1	10.02	Drive running
2	10.03	Zero speed
3	18.45	Tracking error
4	18.46	Web break
5	18.47	Tensioned
6	18.32	Speed mode selected
7		At minimum diameter
8		At maximum diameter
9		Diameter hold applied
10		Slack web detected
11		At line speed
12		
13		
14	18.49	Watchdog Error Flag
15	WDout	Watchdog out Comms. Clock

WDout is the communication watchdog bit transmitted from the UD70/MD29 to a remote intelligent device, (keypad or CTIU, etc).

Status Word2 _R71% (Parameter 72.71)
Winder Status Confirmation Bits

The Winder drive can be controlled locally via the drive terminals or remotely via serial communications using the control word. This status word bits provides common acknowledgment of the commanded status of the winder drive.

b15	b14	b13	b12	b11	b10	b9	b8
			PID HOLD	PID ON	PID RST	STALL TENS	TENS ON

b7	b6	b5	b4	b3	b2	b1	b0
		COUPL	MASK	JOG REV	JOG FWD	RUN FWD	Inhibit

Bit	Parameter	Description
0	Inhibit	Drive is Inhibited
1	RUN FWD	Drive Run Forward Commanded
2	JOG FWD	Drive Jog Forward Commanded
3	JOG REV	Drive Jog Reverse Commanded
4	MASK	Mask Bit set for remote control
5	COUPL	Drive Coupling Commanded
6		
7		
8	TENS ON	Tension On Commanded
9	STALL TENS	Winder in Stall Tension
10	PID RST	PID reset commanded
11	PID ON	PID on commanded
12	PID HOLD	PID hold commanded
13		
14		
15		

Menu 72 & 73 Parameters

When using local communications connection on SM-Application module (e.g .RS485 or CTNet), these parameter can access directly, (e.g. _RXX% (or 72.XX) and _Sxx% (or 73.XX) register. When trying to access these parameter s from another SM option module (fieldbus, another SM-Application module) or the Unidirive-SP RS485 port then the routing address menu must be used. Please refer to the Unidrive-SP SM-option modules manual for more information.

9.1.3 CTNet Configurable Input Cyclic Data

To enable some of the winder parameters to be easily written to when using CTNet, four addition user configurable mapping parameter have been provided. This enables an efficient way of sending a block parameter data using one or more CTNet cyclic link.

CTNet Receiving Parameter	Allocation	Destination Parameter
73.00 (_S00%)	CTNet In Mapping Parameter 1	70.60
73.01 (_S01%)	Line Speed	-
73.02 (_S02%)	Line Acceleration	-
73.03 (_S03%)	CTNet In Mapping Parameter 2	70.61
73.04 (_S04%)	CTNet In Mapping Parameter 3	70.62
73.05 (_S05%)	CTNet In Mapping Parameter 5	70.63

9.1.4 CTNet Output Data

To enable common system parameters to be easily read when using CTNet a function is available to send this group of data, (listed below), to a specific CTNet Node or to broadcast to all CTNet node on the network, that can accept cyclic fast data.

Setting Parameter 70.43 to:

–1 (or if an MD29AN) will disable this function
0 Broadcast to all nodes
>1 Data sent to a specific node address.

The CTNet destination registers can be determined by setting the destination start register number in parameter 70.67.

e.g. if parameter 70.67 = 11 then the CTNet destination registers would start at 73.11 and finish at 73.15.
70.67 = n

Data

Winder Parameter	Description	Target Node Receiving registers
72.70	Statusword 1	73.n
72.71	Statusword 2	73.n+1
71.06	Actual Tension/Dancer Feedback	73.n+2
71.01	Actual Diameter	73.n+3
71.07	Tension Feed-forward	73.n+4

10 Parameter Set-up Tools

The parameter tool available on the CD assists the user to configure and maintain the drive and application parameters from the PC. The parameter tool used is called ‘Libra’.

10.1 Libra

The Libra programme can communicate to the drive via:

1. The SM Application module’s
   a. RS485 port
   b. CTNet
2. The Unidrive-SP RS485 Port(Rj45), using the Control Techniques RS232 to RS485 converter lead.

Libra has the following features:

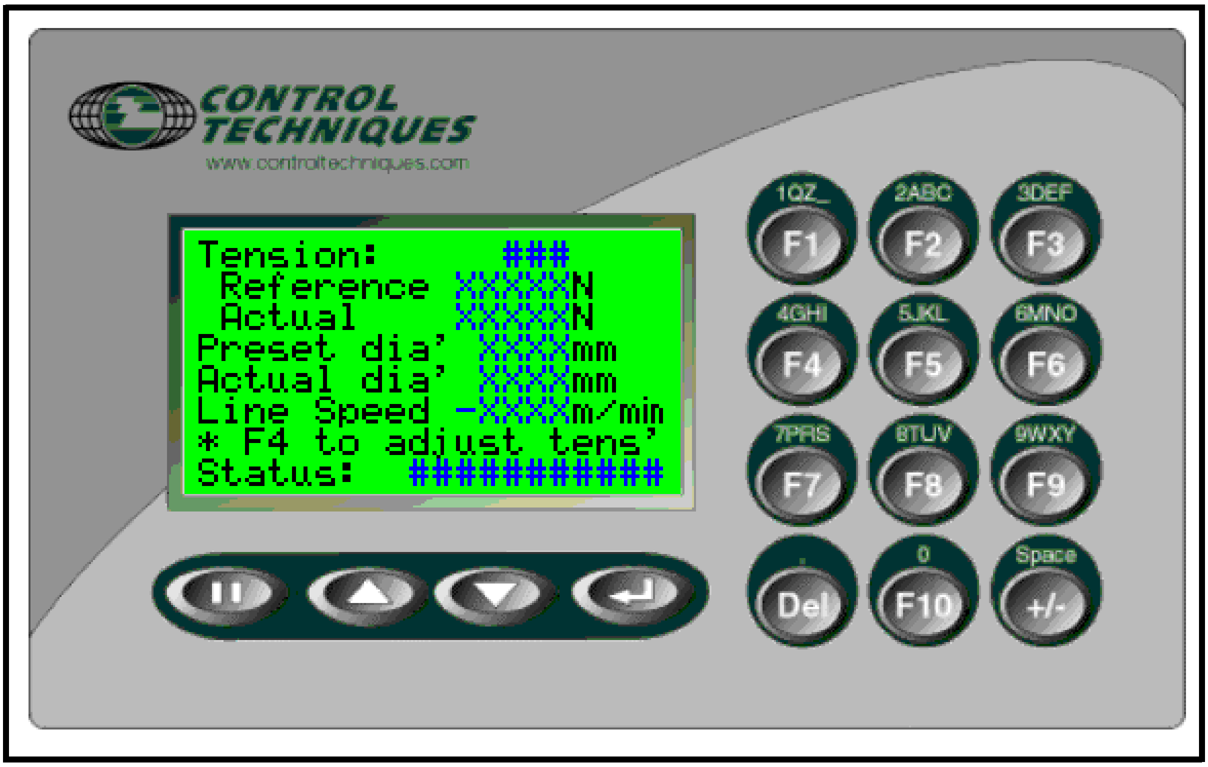
- Parameter Upload Download
- Parameter configurations save to file
- Compare
- Custom & Parameter listings
- Graphical representation of the drive menu parameters

11 CTIU – Operator Panel

11.1 Introduction

The CTIU operator interface enables the user to monitor, set-up and control the winder application remotely reducing the need to use the manual or Unidrive-SP parameter numbers. All parameters are displayed in text rather than using it's Unidrive-SP parameter number. Textual descriptions are also given for trips/alarms, Boolean statuses/settings and selection parameters. On line Help descriptions are available for certain configuration parameters where there function is not clear. The illustrations in this chapter show screen shots from the programming tool and will show characters such as xxx or ### where a numeric or text variable would be expected.

Front View of CTIU110



11.2 Software Version

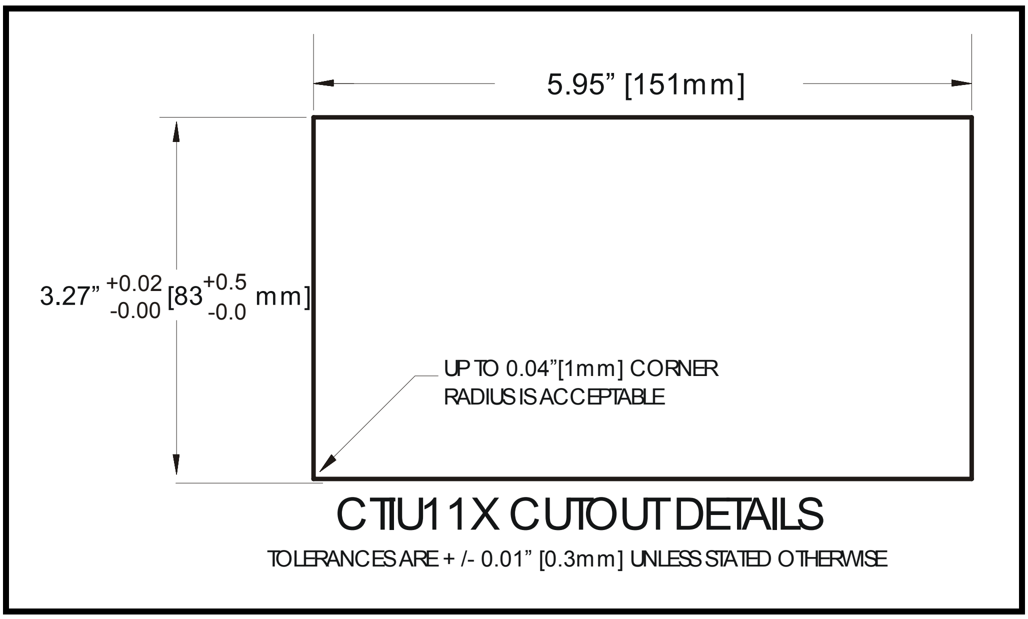
CTIU Software Version – V01.00.00 or greater, this will be displayed on the CTIU second splash screen or can be found under the 'Drive Diagnostics' menu.

11.2.1 Configuration file version

There are two configuration files one for winders operating in metric units, the other for winders operating in imperial units. The appropriate file will be selected by Winflasher 3 if you are using this tool. If you have to download the CTIU configuration files manually then you should choose AC Winder metric.cmc for metric machines of AC Winder Imperial.cmc for imperial machines. If you try to run the metric configuration on an winder control set for imperial or vice versa the CTIU will not operate and will display a warning and recovery message as shown below.

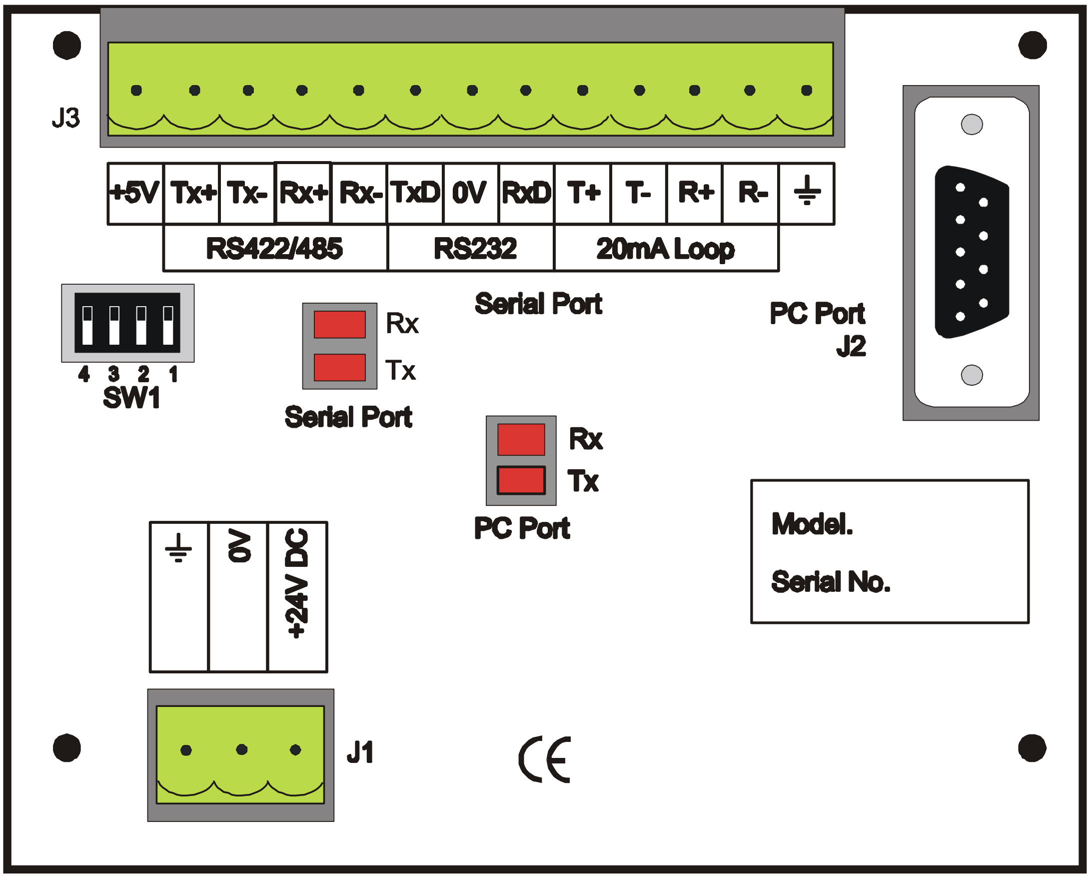
11.3 Mechanical Installation

11.3.1 Panel Cut-out Detail



11.4 Electrical Installation

11.4.1 CTIU110 Rear View

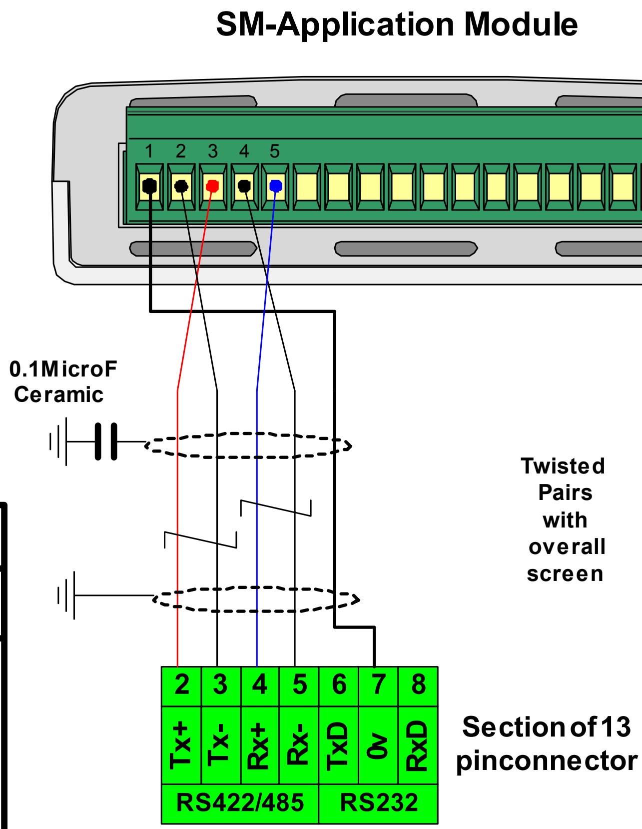


24Vdc Power Supply Requirements (J1)

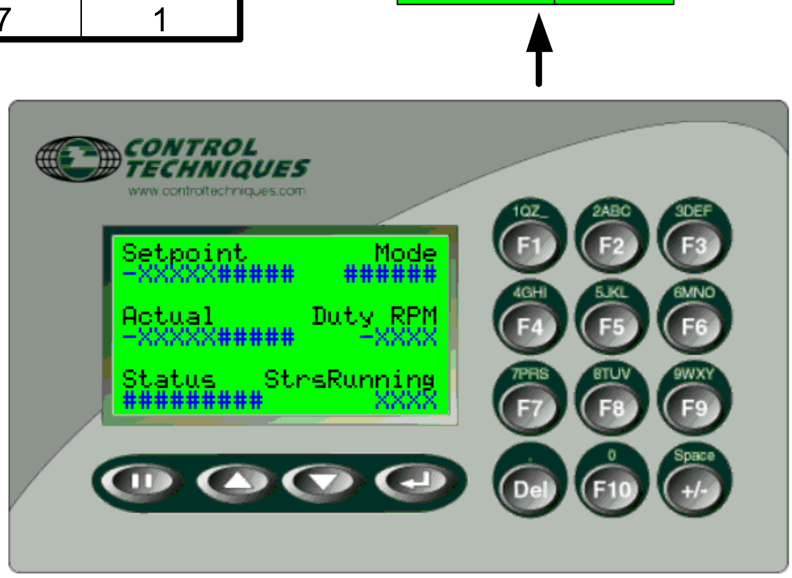
Peak Inrush – 240mA

Continuous – 100mA

11.4.2 Serial Communications Cable Connections



Connections	
CTIU	SM-App
2	3
3	2
4	5
5	4
7	1



CTIU

Recommended Cables

Belden No. 8105, 9807 or 9832 – General Purpose

Belden No. 8165 – Heavy Noise Environment

11.5 Unidrive-Sp set-up

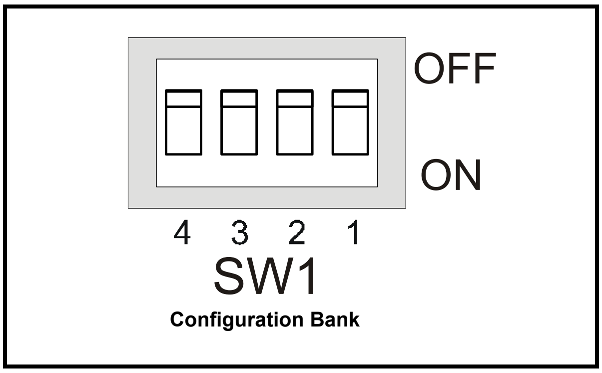
The protocol used between the CTIU110 and the Unidrive-SP applcation module is Modbus RTU. To establish communications, the Unidrive-SP Address, Baud rate and Protocol is required to be set.The following table details the required parameters to be set:

Parameter	Setting	Description
##.05	11	Drive address
##.06	13	RS458 Modbus-RTU protocol mode
##.07	9600	Baud rate

The menu number is dependant on the slot the SM-Application module is fitted. Refer to section *Slot Menus* on page 17 for more details.

NOTE Perform a Drive save to save these setting during power down.
e.g. XX.00 = 1000 followed by reset.

11.5.1 CTIU110 Configuration of the RS-485 Port



The configuration bank sets the parameters of the RS-485 port as described in Table.

Configuration Bank Description	
Switch 1	ON: Pull-up (must be used together with switch 3) OFF: no Pull-up
Switch 2	ON: 120Ω termination OFF: no termination
Switch 3	ON: Pull-down (must be used together with switch 1) OFF: no Pull-down
Switch 4	Reserved for future use
NOTE	Switch 1 and 3 must be used together. Either both pull-up and pull-down are used or neither is used.

Pull-up and **Pull-down** switches are used to increase the signal level on the RS-485 bus. This is useful if there is a long bus and a significant amount of attenuation is anticipated.

Termination resistance of 120Ω must be placed across each end of the RS-485 bus. With switch 2 ON, a 120Ω resistance is placed across the bus. This should only be used if the CTIU050/100/110 is the last device at either end of the bus.

11.6 Operation Button Selection Actions

PAUSE key selects data for editing OR exits from data editing.

PAUSE & DOWN keys pressed together, enters sub menu pages.

PAUSE & UP keys pressed together, exits sub menus to the parent menu pages.

UP key selects the previous menu page, sub menu page, alarms, and increments data.

DOWN key selects the next menu page, sub menu page, alarms and also decrements data.

ENTER key sends data to the automation equipment, accepts alarms, and displays accepted alarms.

ALPHANUMERIC KEYPAD and **PROGRAMMABLE KEYS** can be used to enter data or can be used to preform some pre-programmed action.

Contrast Adjustment

On menu page 1 (after the start-up screen), hold the ENTER key and press the UP or DOWN key to adjust the contrast. The contrast setting is stored and not lost after removing power.

11.7 Navigation

The winder screens are split into 2 sections:

- Operator section
- Configuration section

The winder parameters are grouped into relevant application menus to aid efficient navigation to each parameter. Each menu has two parts:

- A parent menu page, this is the menu header and displays the menu description.
- Sub-menu page/s containing all the relevant parameters for the selected menu.

For example - Parent Menu Page: I/O Diagnostics

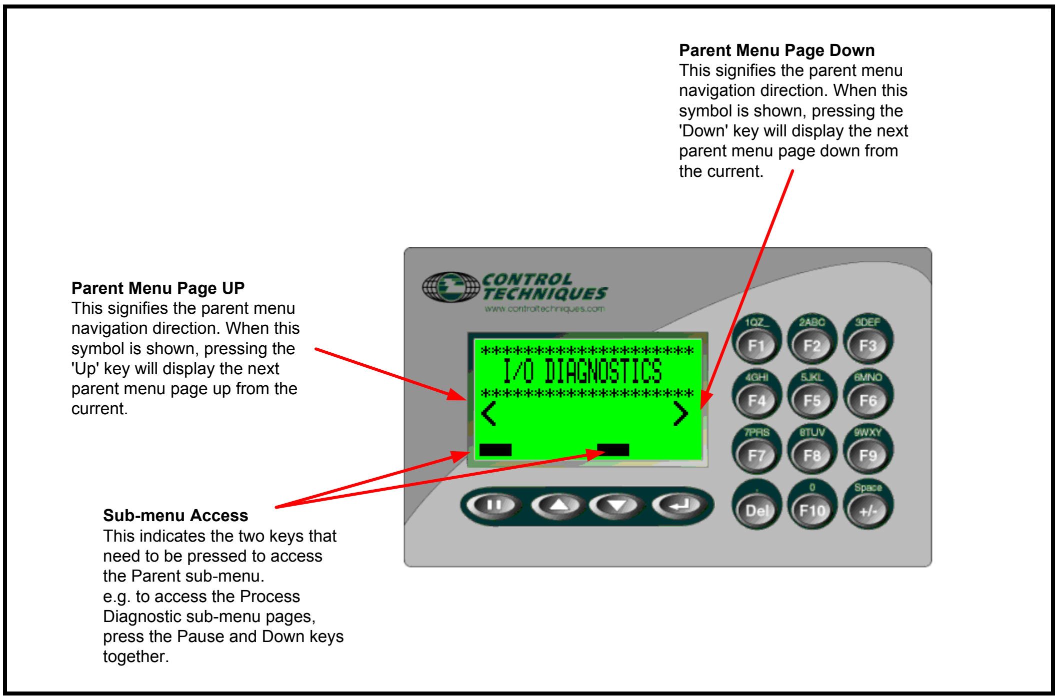
Sub-menu Pages contain relevant parameter for the Parent Menu:

All status of the Digital Inputs and Outputs Terminals: 1 & 2 and 24 - 30.

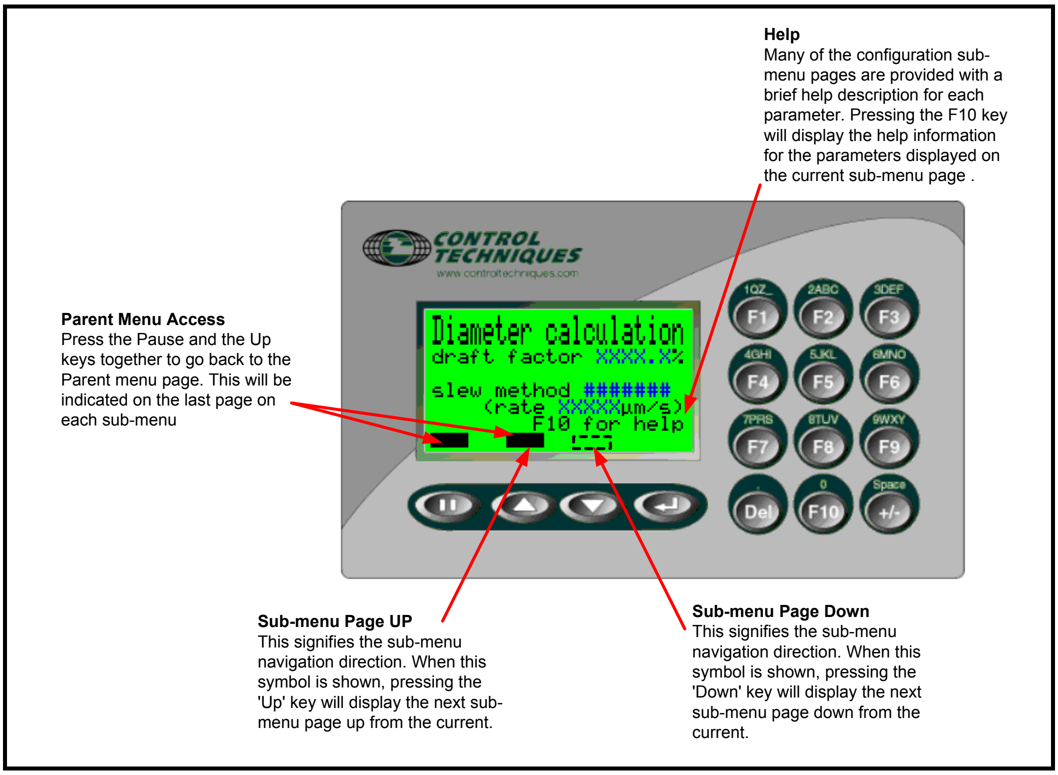
The current values on all Analogue input terminal: 05 - 08.

Using on-screen graphical icons the following sections describe how to navigate between Parent and sub-menu screens.

11.7.1 Parent Menu Pages Navigation



11.7.2 Sub Menu Pages Navigation



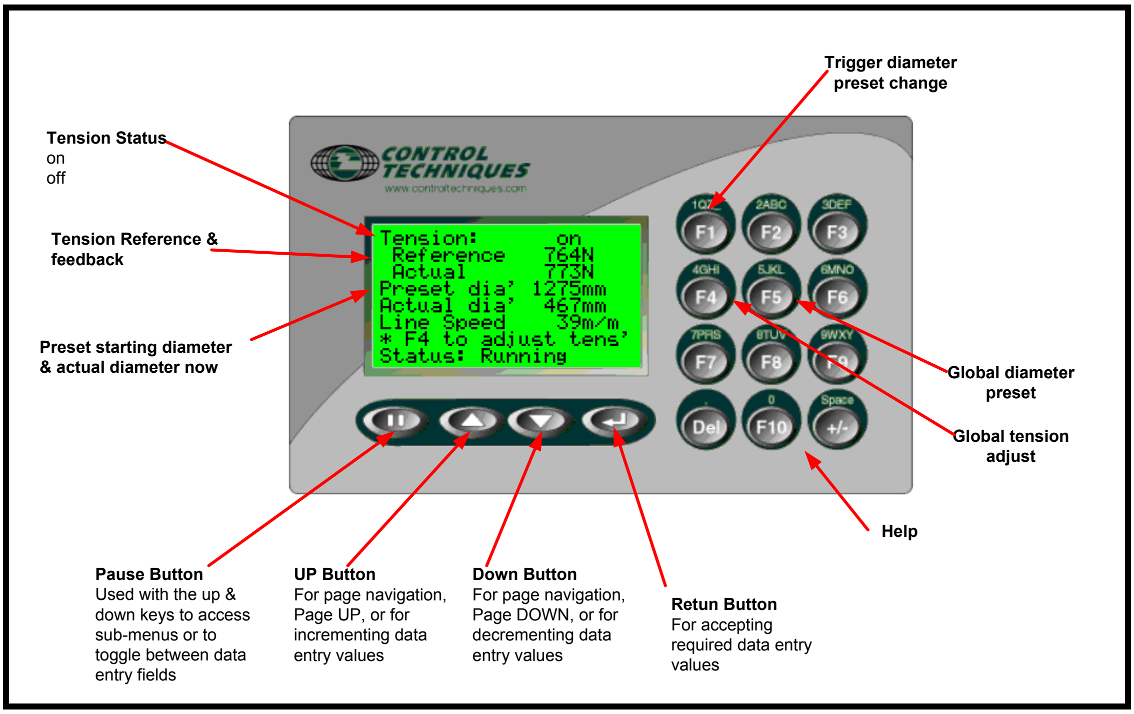
11.8 Operators Screens Description

The operator screens consist of:

- Top-level main page which provides an overview of all the important parameters of the winder on one screen
- Diagnostic information for drive and the application
- Process set points.

These screens are detailed in the Operators navigation diagram shown below.

11.8.1 Top Level Screen and Functionality

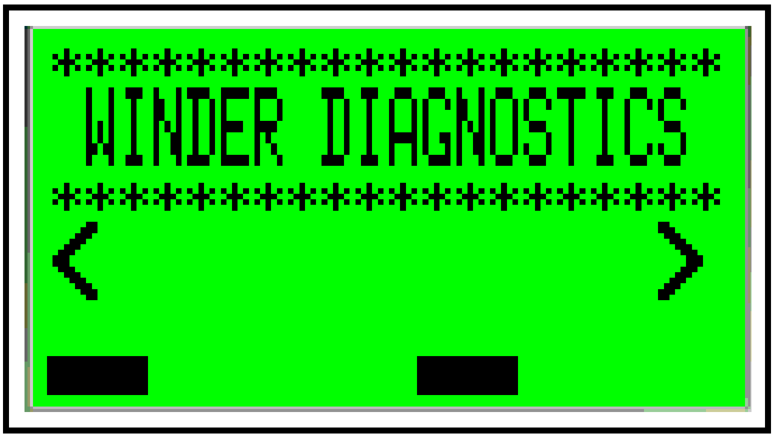


The top-level screen indicates the major process variables for the winder. The Top-level screen is always the first menu Page to be displayed. A Menu Timeout, safety feature is used to force the CTIU display focus back to the first (main) menu page if no activity (key presses) occur for 30 seconds.

11.8.2 Diagnostic Screens

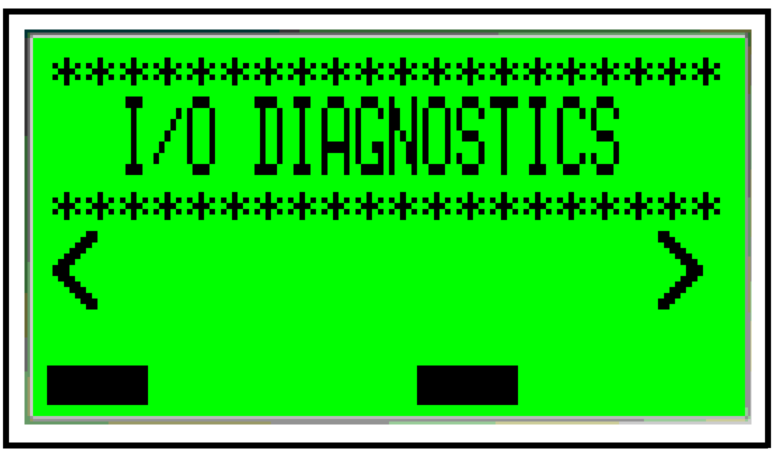
The following diagnostic screens are available:

Winder Diagnostics - Displays parameters directly related to the winder control such as settings, feedbacks, errors.

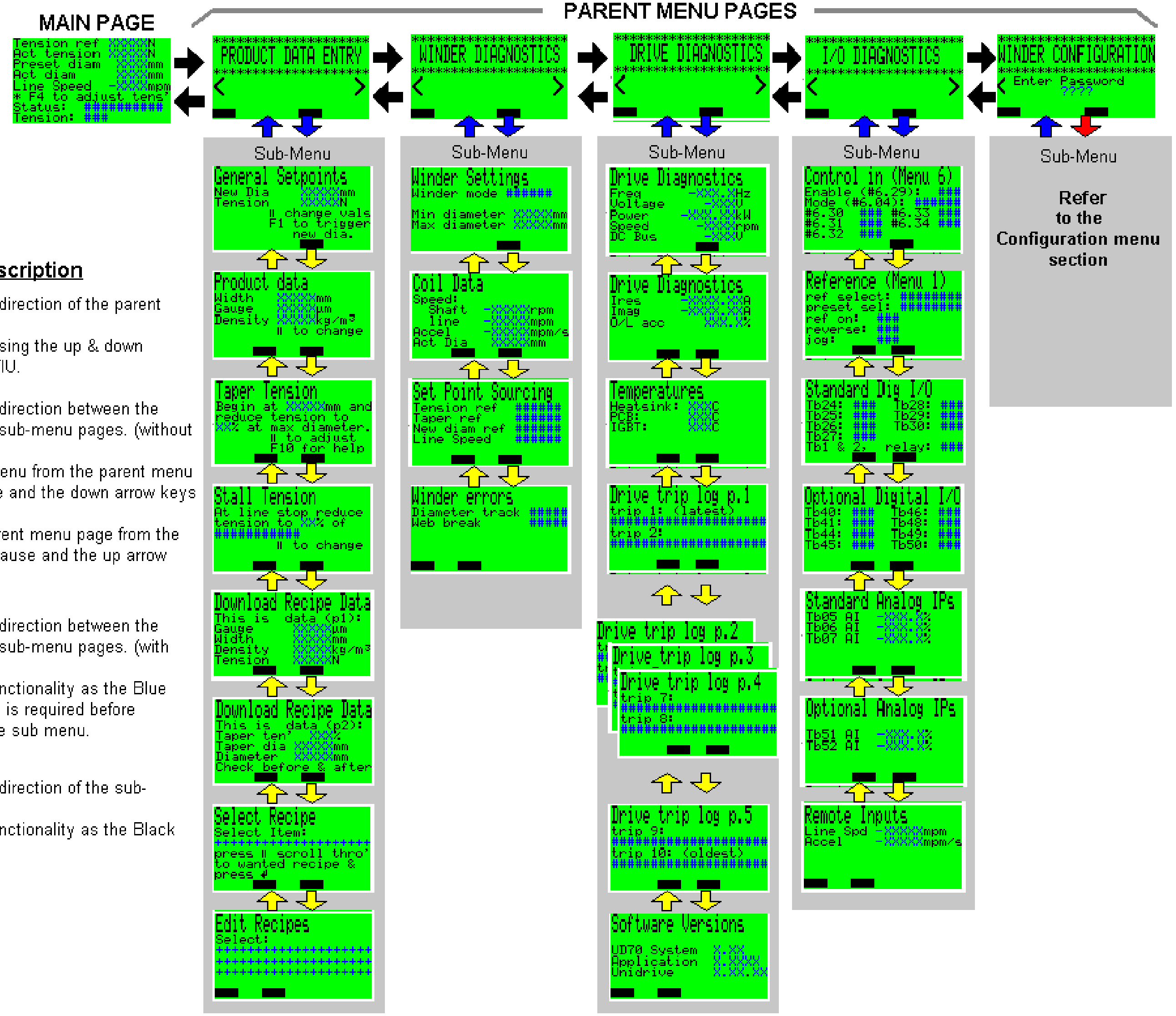


Drive Diagnostics - Displays parameters directly related to the drive, Power, Speed, DC Bus Volts, Current, Overload accumulator, etc; Fault log; Software versions.

I/O Diagnostics - Displays parameters directly related to the drive inputs & outputs, Unidrive-SP standard and option digital status's and analogue current values, reference flow is also shown.



Operator Navigation



Navigation Arrow Description

- Denotes navigation direction of the parent Menu pages.
This is achieved by using the up & down arrow keys on the CTIU.

- Denotes navigation direction between the parent menu page & sub-menu pages. (without password).
To access the sub-menu from the parent menu page press the pause and the down arrow keys together.
To go back to the parent menu page from the submenu press the pause and the up arrow keys together.

- Denotes navigation direction between the parent menu page & sub-menu pages. (with password).
This has the same functionality as the Blue arrow but a password is required before access to given to the sub menu.

- Denotes navigation direction of the sub-menu pages.
This has the same functionality as the Black arrow.

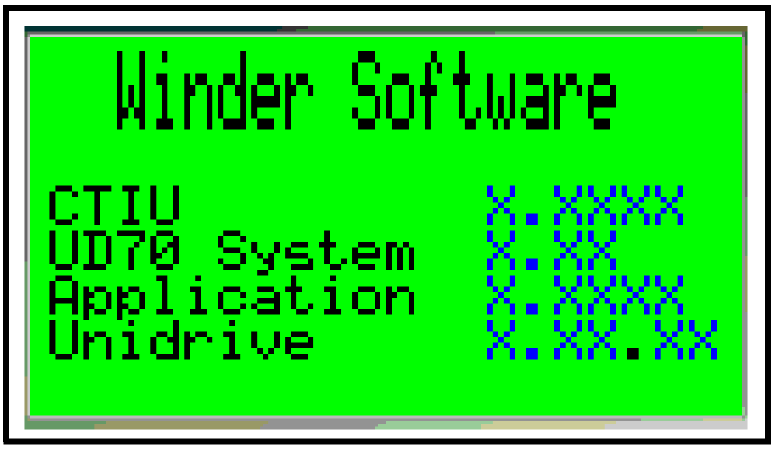

Configuration Navigation
Configuration Parent Menu Pages
ANCILLIARY SPEED & TORQUE REFERENCES
LOSS COMPENSATION
PID
DIAMETER CALCULATION
REFERENCING DATA SOURCES
ENCODER DATA
DIGITAL IO SETUP
ANALOG IO SETUP
WINDER MODES AND WATCHDOG SETUP
REFERENCE DATA SCALING
TAPER TENSION SETUP
WINDER DIMENSIONS
MOTOR DATA
Help pages accessed by F10
Page selection determined by auto detection of option module
For navigation arrow key see previous page

11.9 Splash Screens

There a two splash screens displayed in sequence during initial power up. These detail the application and software version information.

11.9.1 Application Page (1st Page)

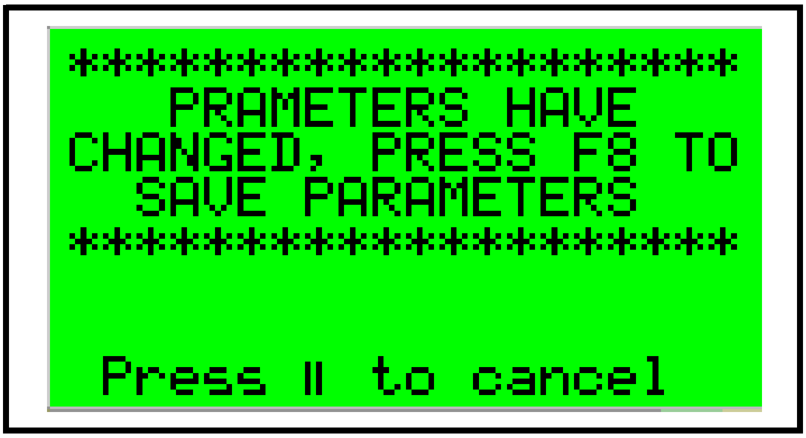
11.9.2 Software Version Page (2nd Page)



11.10 Parameter Save

When any of the editable data fields has been changed within the configuration menus and the Top-level menu page (1) is display (due to timeout, or forced by the user), a parameter save will be prompted to the operator.

11.10.1 Parameter Save Main Screen



This is the first screen to be displayed, where it indicates to the user to save parameters by pressing Function key F5. To save the parameters the Unidrive-SP must be in stopped state; a flashing message will advise if a save can be performed.

For example: Flashing Message

Drive Running – Stopped OK to Save

Drive Stopped – Running cannot save

If a parameter save is not required the pause (||) key can be press to quit back to the Top-level menu page (1).

11.10.2 Parameter Save Acknowledgement Screen

When function key F5 is press with the Drive stopped the above screen will appear acknowledging a parameter save is being performed. After approximately 5 seconds the top level menu page (1) will re-appear, confirming the save has completed. Two other screens will warn if the save action fails.

11.11 Trip & Alarm indication

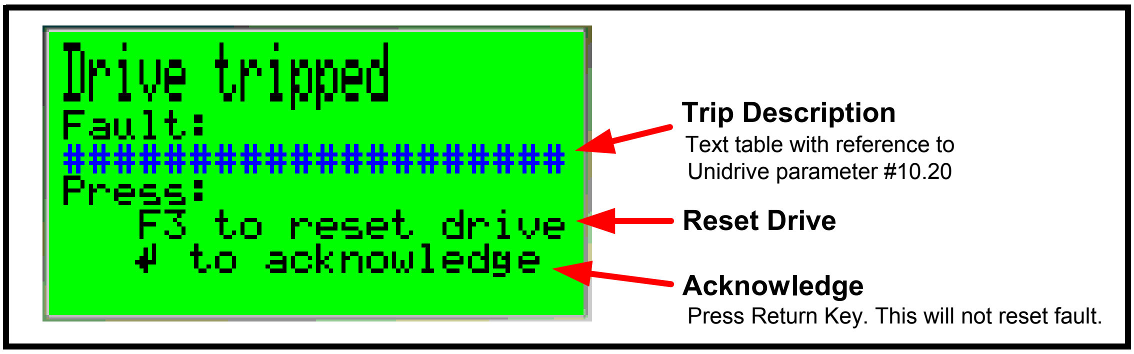
There are 4 Alarm pages:

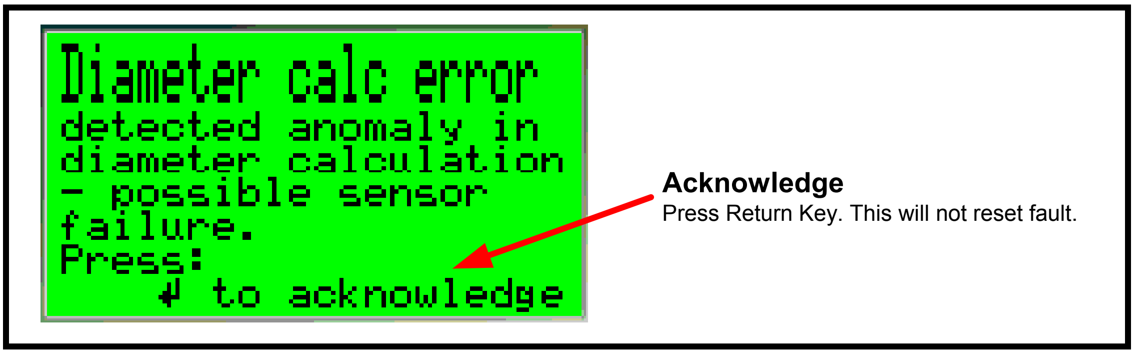
- Drive Trip – Indication the winder drive has tripped and needs a reset to resume operation. (Unless the result of the trip has caused permanent damage) The trip reason will be decoded and displayed on the screen. The user is offered the facility to reset the drive.
- Diameter calculation error – The software has detected an anomaly in the diameter calculation, non-resettable.
- Web Break Detected – The software has detected a web break, non-resetable.
- Watchdog - The Winder Control Software watchdog has tripped, probably due to a communications failure, non-resettable.

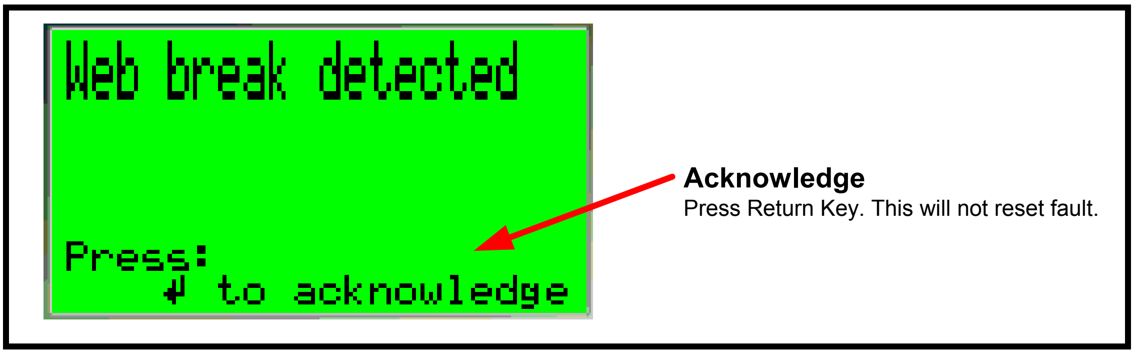
All pages have to be acknowledged by the pressing of the 'Return' key. This will remove the Alarm page from the display only; this will not reset any trips or alarms on the drive. A drive trip can be reset from the CTIU (F3 key), or from another source (Pushbutton, Drive control panel, line controller etc). When an alarm is acknowledged but not reset, the Alarm page will be removed from the display of the CTIU.

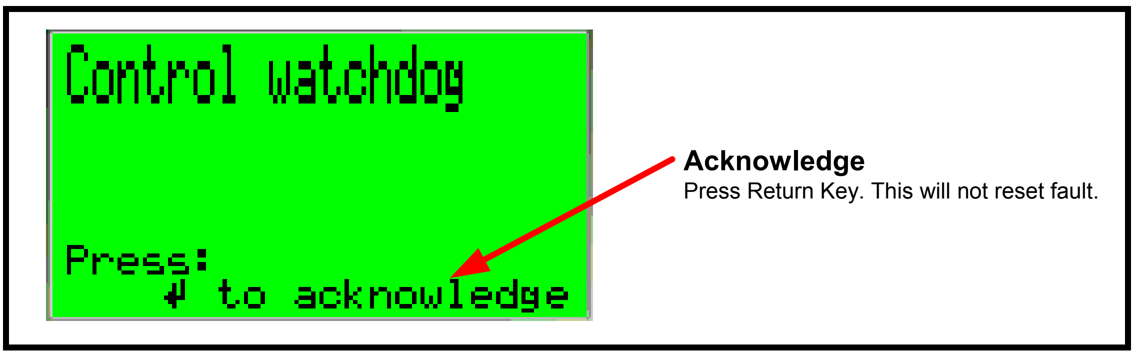
The non-resettable conditions will require intervention for maintenance staff.

11.11.1 Alarm Pages









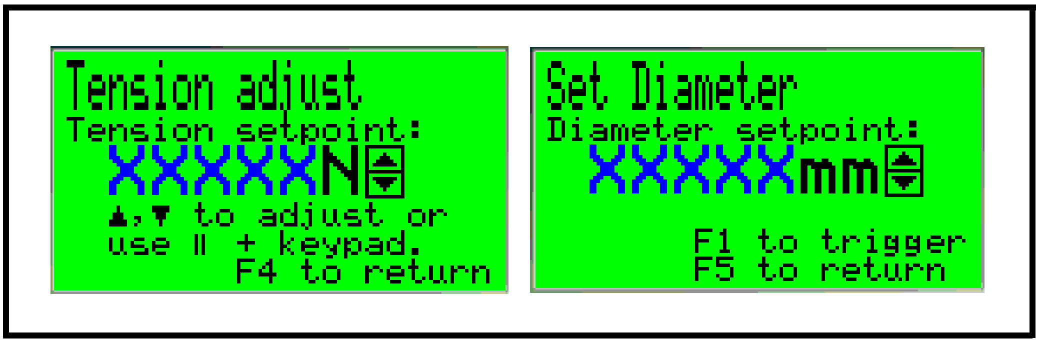
11.12 CTIU Function Keys Allocation

11.12.1 Global Control Function Keys

The following Function keys are always available on any screen. These functions allow the winder tension and preset diameter to be quickly accessed and adjusted.

F4 – Tension Adjust. displays a page providing fast & immediate spin button adjustment of tension, using the up & down keys.

F5 – Diameter adjust, displays a page providing fast & immediate spin button adjustment of diameter, using the up & down keys. F1 must be pressed to load the new diameter.



11.12.2 Local Function Keys

The following are defined as local function keys as they are only apply to one or range of pages.

- F1 – Trigger diameter preset change.
- F3 – Drive reset available on I/O setup pages and the drive trip alarm page.
- F8 – Parameter save offered automatically when drive parameters have been changed.
- F10 – Help a few pages have descriptive helps aimed at clarifying obscure parameter use.

12 Quick Reference

12.1 Unidrive-SP

12.1.1 Relevant Parameter

01.01	Reference selected
01.06	Maximum Frequency Clamp
01.07	Minimum Frequency Clamp
01.10	Bipolar reference select
01.11	Reference enabled indicator
01.14	Reference selector
01.15	Preset selector
01.21	Preset Speed reference 1
02.01	Post ramp speed reference
02.02	Ramp enable
02.04	Ramp mode
02.10	Acceleration Selector
02.11	Acceleration Rate
02.20	Deceleration Selector
02.21	Deceleration Rate
03.05	Zero Speed Threshold
03.10	Speed Controller Proportional Gain Kp1
03.11	Speed Controller Integral Gain Ki1
03.12	Speed Controller Differential Feedback Gain Kd1
03.34	Number of encoder lines per rev
04.01	Motor current magnitude
04.07	Symmetrical Current Limit
04.09	Percentage Torque Offset (Compensation)
04.10	Torque Offset Enable
04.11	Torque Mode Selector
04.15	Thermal Time Constant
05.01	Motor Frequency
05.02	Motor Voltage
05.03	Motor Power
05.04	Motor Speed
05.05	DC Bus Voltage
05.06	Motor rated Frequency
05.07	Motor rated Current
05.08	Motor rated Full load r/min
05.09	Motor rated Voltage
05.10	Motor rated Power Factor
05.11	Number of Motor poles
05.12	Magnetising Current test Enable
05.18	Switching Frequency
06.01	Stop mode selector
06.04	Sequencing Mode
06.08	Hold Zero Speed
06.15	Drive enable
11.23	Serial comms. address
11.24	Serial comms. mode selector
11.25	Serial comms. baud rate selector
11.26	Minimum Comms Transmit Delay

12.1.2 I/O Parameters

Standard Unidrive-SP I/O

No.	Description	Term.
07.01	Analogue Input 1 Indication	5 & 6
07.02	Analogue Input 2 Indication	7
07.03	Analogue Input 3 Indication	8
07.08	Analogue input 1 scaling	
07.09	Analogue input 1 invert	
07.10	Analogue input 1 destination	
07.11	Analogue input 2 mode selector	
07.12	Analogue input 2 scaling	
07.13	Analogue input 2 invert	
07.14	Analogue input 2 destination	
07.15	Analogue input 3 mode selector	
07.16	Analogue input 3 scaling	
07.17	Analogue input 3 invert	
07.18	Analogue input 3 destination	
07.19	Analogue output 1 source	9
07.20	Analogue output 1 scaling.	
07.21	Analogue output 1 mode selector	
07.12	Analogue output 2 source	10
07.23	Analogue output 2 scaling.	
07.24	Analogue output 2 mode selector	
08.01	Digital input / output F1 state indicator	24
08.02	Digital input / output F2 state indicator	25
08.03	Digital input / output F3 state indicator	26
08.04	Digital input F4 state indicator	27
08.05	Digital input F5 state indicator	28
08.06	Digital input F6 state indicator	29
08.07	Relay 1 output indicator	41 & 42
08.09	External trip / inhibit input state indicator	31
08.10	External trip / inhibit input mode select	
08.21	F1 destination or source parameter	
08.11	F1 Invert	
08.31	F1 output enable	
08.22	F2 destination or source parameter	
08.12	F2 Invert	
08.32	F2 output enable	
08.23	F3 destination or source parameter	
08.13	F3 Invert	
08.33	F3 output enable	
08.24	F4 destination or source parameter	
08.14	F4 Invert	
08.25	F5 destination or source parameter	
08.15	F5 Invert	
08.26	F6 destination or source parameter	
08.16	F6 Invert	
08.27	Relay 1 source	
08.17	Relay 1 output Invert	
08.29	Positive logic select	
08.30	Open Collector Outputs	

Additional I/O SOM

No.	Description	Term.

##.07	Relay 2 output indicator	21-22
##.08	Relay 3 output indicator	23-42
##.40	Analogue input 4 level	9
##.44	Analogue input 5 level	10
##.09	Digital Input / Output F7 state indicator	2
##.10	Digital Input / Output F8 state indicator	3
##.03	Digital Input / Output F9 state indicator	4
##.04	Digital Input F10 state indicator	6
##.05	Digital Input F11 state indicator	7
##.06	Digital Input F12 state indicator	8
##.41	Analogue input 4 scaling	
##.42	Analogue input 4 invert bit	
##.43	Analogue input 4 destination	
##.45	Analogue input 5 scaling	
##.46	Analogue input 5 invert bit	
##.47	Analogue input 5 destination	
##.48	Analogue Output 3 source	54
##.49	Analogue output 3 scaling	
##.21	F7 destination or source parameter	
##.11	F7 Invert	
##.31	F7 output enable	
##.22	F8 destination or source parameter	
##.12	F8 Invert	
##.32	F8 output enable	
##.23	F9 destination or source parameter	
##.13	F9 Invert	
##.33	F9 output enable	
##.24	F10 destination parameter	
##14	F10 Invert	
##.25	F11 destination parameter	
##.15	F11 Invert	
##.26	F12 destination parameter	
##.16	F12 Invert	
##.27	Relay 2 source	
##.17	Relay 2 output Invert	
##.28	Relay 3 source	
##.18	Relay 3 output Invert	
##.29	Logic input polarity	

12.2 Application

12.2.1 Menu 18

No.	Description	Type	Units	Range	Default	Setting
18.01	Current Diameter display	RO	mm 0.1”	18.16- 18.17	-	
18.02	Preset diameter value	RO	mm 0.1”	18.16- 18.17	-	
18.03	Required tension as per unit value use for E/P output	RO	PU	0-32767	-	
18.04	Line Speed	RO	0.1m/min 0.1ft/min	0-18.29	-	
18.05	Winder Speed	RO	r/min	0-32767	-	
18.06	Motor Speed	RO	r/min	0-32767	-	
18.07	Actual Tension	RO	N lbf	0–18.30	-	
18.08	Tension feed forward	RO	N lbf	0-32767	-	
18.09	Diameter Hold Flag	RO	Bit	-	-	
18.10						
18.11	Diameter Hold function speed threshold	RW	r/min	1-32767	1	
18.12	Offset speed	RW	m/min ft/min	0–32767	0	
18.13	Percentage of Tension applied as Stall Tension	RW	%	0-100	0	
18.14	PID control P gain	RW	0.001Kp	0-32767	0	
18.15	PID control I gain	RW	0.1Ki	0-32767	0	
18.16	Minimum diameter	RW	mm 0.1”	1-32767	1	
18.17	Maximum diameter	RW	mm 0.1”	18.16- 32767	1	
18.18	Material gauge	RW	Microns 0.001”	1-32767	1	
18.19	PID D Gain	RW	0.1Kd	0-32767	0	
18.20	Limit on PID output	RW	Tension-% Speed- cm/min 0.01in/min	0-100.0 0-32767	0	
18.21	Motor base Speed	RW	r/min	1-32767	1	
18.22	Motor base Power	RW	0.1kW 0.1hp	1-32767	1	
18.23	Gear ratio	RW	0.01	100-32767	100	
18.24	Centreing Window	RW	-PU	0-32767	0	
18.25	PID Filter	RW	-	0-32767	0	

18.26	Material width	RW	mm inches	1-32767	1	
18.27	Material density	RW	kgms/m^3 lb/ft^3	1-32767	1	
18.28	Mandrel inertia	RW	kgms/m^2 lb.ft^2	0-32767	0	
18.29	Maximum line speed	RW	m/min ft/min	1-32767	1	
18.30	Maximum Tension in Newtons	RW	N lbf	1-32767	1	
18.31	Select Dancer or Load cell feedback	RW	Bit	0 - 1	0	
18.32	Select Speed Mode of operation	RW	Bit	-	0	
18.33	Tension On command	RW	Bit	-	0	
18.34	Set stall tension as percentage of Maximum tension	RW	Bit	-	0	
18.35	Select direct measurement of diameter via analogue input	RW	Bit	-	0	
18.36	Select Over or Under winding direction	RW	Bit	-	0	
18.37	Select condition which switches from Stall to Run tension	RW	Bit		0	
18.38	Preset diameter command bit	RW	Bit	-	0	
18.39	Select to operate as an Unwind	RW	Bit	-	0	
18.40	Hyperbolic Taper select	RW	Bit		0	
18.41	PID Enable	RW	Bit	-	0	
18.42	PID Hold integral	RW	Bit	-	0	
18.43	PID Reset integral	RW	Bit	-	0	
18.44	Diameter Calculation Mode	RW	Bit	-	0	
18.45	Diameter calculation error flag	RO	Bit	-	0	
18.46	Web break error flag	RO	Bit	-	-	
18.47	Web Tensioned Flag	RO	Bit	0-1	-	
18.48	Select Loss Profiler Compensation	RW	Bit	-	0	
18.49	Watch dog trip	RO	Bit	-	-	
18.50	Select the form of engineering units for set up data	RW	Bit		0	

12.2.2 Menu 19

No.	Description	Type	Units	Range	Default	Setting
19.01	Tension torque component	RO	Nm lb.ft	0-32767	-	
19.02	Compensation torque	RO	Nm lb.ft	-32768 to +32767	-	
19.03	PID error	RO	TorquePU Speed pos	+/-1000 -32768 to +32767	-	
19.04	Final Speed Reference	RO	0.1m/min 0.1ft/min	0-32767	-	
19.05	Acceleration rate	RO	m/min/s ft/min/s	-32768 to +32767	-	
19.06	PID Output	RO	cm/min 0.1ft/min	+/-18.20		
19.07	Calc. Diameter before slew	RO	mm 0.1”	0 – 32767	-	
19.08	Actual Slew rate limit Applied	RO	Microns/sec	0 – 32767	-	
19.09	Final Tension reference before taper	RO	N	0-Max tension	-	
19.10	Initial Tension reference after taper	RO	N	0-Max tension	-	
19.11	Preset1 diameter value	RW	mm 0.1”	18.16-18.17	1	
19.12	Preset2 diameter value	RW	mm 0.1”	18.16-18.17	1	
19.13	Fixed value for Diameter slew rate	RW	Microns per sec	1-32767	1	
19.14	Thread/Inch speed	RW	m/min ft/min	0-18.29	0	
19.15	Friction loss	RW	0.1%	0-1000	0	
19.16	Viscous loss	RW	0.1%	0-1000	0	
19.17	Diameter at which Taper Tension will start	RW	mm 0.1”	18.16-18.17	1	
19.18	Tension reference ramp time	RW	0.1s	0-32767	1	
19.19	Motor inertia	RW	$kg.m^2$ $lb.m^2$	0-32767	0	
19.20	Dancer Position Set point	RW	-	0-32767	0	
19.21	Tension reference Analogue format	RW	PU	0-32767	0	
19.22	Taper reference Analogue format	RW	PU	0-32767	0	
19.23	Preset Diameter Analogue format	RW	PU	1-32767	1	

19.24	Load cell / Dancer feedback	RW	PU	0-32767	0	
19.25	Line Speed reference Analogue format	RW	PU	0-32767	0	
19.26	Tension Set point (Digital)	RW	N lbf	0-18.30	0	
19.27	Taper Set point (Digital)	RW	%	0-100	0	
19.28	Centreing Acceleration	RW	CM/M/S ins/min/s	0-32767	0	
19.29	Centreing Speed	RW	m/min ft/min	0-18.29	0	
19.30	Line Speed Slip factor	RW	0.001%	100-2000	1000	
19.31	Select serial input for Line Speed reference	RW	Bit	-	0	
19.32	Select fixed diameter slew limit	RW	Bit	-	0	
19.33	Inch reverse command bit	RW	Bit	-	0	
19.34	Inch Forward command bit	RW	Bit	-	0	
19.35	Select second preset diameter 19.12	RW	Bit	-	0	
19.36	Run forward command bit	RW	Bit	-	0	
19.37	Hold diameter command bit	RW	Bit	-	0	
19.38	Select Tension Set Point from MMI via 19.26	RW	Bit	-	0	
19.39	Select Taper set Point from MMI via 19.27	RW	Bit	0	0	
19.40	Select Diameter Set Point from MMI via 19.11 or 19.12	RW	Bit	-	0	
19.41	Reverse direction of diameter change under Lap or Traverse	RW	Bit	-	0	
19.42	Signal Traverse reversal	RW	Bit	-	0	
19.43	Select Traverse mode for diameter calculation	RW	Bit	-	0	
19.44	Coupling enable	RW	Bit	-	0	
19.45	Select acceleration signal	RW	Bit	-	0	
19.46	Speed reference polarity	RO	Bit	-	-	
19.47	Select Torque Memory	RW	Bit	-	-	
19.48	Enable Lay On Tension boost	RW	Bit			
19.49	Enable Index Tension boost	RW	Bit			

12.2.3 Menu 20

No.	Description	Type	Units	Range	Default	Setting
20.20	Watchdog Clock Time	RW	0.01sec	0-32767	0	
20.21	Watchdog trip delay	RW	0.1sec	0-32767	0	
20.22	Winder Speed Sample Time	RW	mS	10-10000	10	
20.23	Analogue Line speed signal acceleration sample time	RW	10mS	1-100	1	
20.24	Index tension boost	RW	0.1% actual tension	0 – 1000	0	
20.25	Lay On tension boost	RW	0.1% max tension	0 –1000	0	
20.26	Speed Boost value	RW	m/min ft/min	–/+ 0% of max line speed	0	
20.27	Select encoder line speed reference	RW	Bit	0 –1	0	
20.28	Watchdog Enable	RW	Bit	0 –1	0	
20.29	Line encoder time base	RW	millisecs	10-10000	100	
20.30	Line encoder RPM	RW	RPM	0-32767		
20.31	Enable Slack Web detection	RW	Bit	0 – 1		
20.32	Slack Web detection threshold	RW	0.1 percent	0 – 1000		
20.33	Acquire Diameter multiplier	RW	Per Unit	1 – 1000		
20.34	Enable Acquire on Start	RW	Bit	0 –1		
20.35	Enable Acquire	RW	Bit	0 – 1		
20.36	Lower limit for diameter hold on slew rate	RW	μm/s *(0.001ins/s)*	0 – 32767	200	
20.37	Lower speed limit of PID gain profiler	RW	Percent of Max speed	0 – 100	10	
20.38	Reset length count	RW	Bit	0 –1	0	
20.39	Application Software Version	RO	-	0-32000	-	
20.40	Coupling speed reference	RW	r/min	0 -10	0	

12.2.4 Menu 70

No.	Description	Type	Units	Range	Default	Setting
70.19	Length of material wound	RW	M/ft	$0 – 2^{32}$		
70.41	Coupling Current limit	RW	0.1%	0 - 1000	1000	
70.42	At Line Speed acceptance window Value	RW	0.1m/min (0.1ft/min)	0-Max speed	0	
70.43	CTNET Output Data Select	RW	-	-1 to 255	0	
70.55	Loss Profiler Pointer	RO	-	0-10		
70.57	Analogue diameter signal min. value	RW	PU	0 – [70.58]	0	
70.58	Analogue diameter signal max. value	RW	PU	[70.57] - 32767	32767	
70.60	CTNet In Mapping Parameter 1	RW	-	100 -9999	100	
70.61	CTNet In Mapping Parameter 2	RW	-	100 -9999	100	
70.62	CTNet In Mapping Parameter 3	RW	-	100 -9999	100	
70.63	CTNet In Mapping Parameter 4	RW	-	100 -9999	100	
70.65	Line / Reference Encoder Source	RW	-	0 - 3	0	
70.66	Feedback Encoder Source	RW	-	0 - 3	0	
70.67	CT Net Out Destination start register	RW	-	0 to 75	70	
70.70 -70.79	Loss Profiler Speed Co-ordinates 0 - 9	RW	r/min	+/- Max Speed(r/min) [01.06]	-	
70.99	Non Volatile store for Actual Diameter	RW	mm	$0 – 2^{32}$	-	

12.2.5 Menu 71

No.	Description	Type	Units	Range	Default	Setting
71.70 – 71.79	Loss Profiler Percentage Loss Co-ordinates 0-9	RW	0.1	0-1000	0	

12.2.6 Menu 73

No.	Description	Type	Units	Range	Default	Setting
73.70	Control Word 0	RW	Bit	-	0	
73.71	Control Word 1	RW	Bit	-	0	

12.3 Categorised Winder Parameters

12.3.1 Common Parameters

General

No.	Description	Type	Units	Range	Default	Setting
18.50	Select the form of engineering units for set up data	RW	Bit	-	0	
18.36	Select Over or Under winding direction	RW	Bit	-	0	
18.39	Select to operate as an Unwind	RW	Bit	-	0	
18.31	Select feed back from Dancer or Load cell (Speed mode)	RW	Bit	0 - 1	0	
18.29	Maximum line speed	RW	m/min *(ft/ min)*	1-32767	1	
19.30	Line Speed Slip factor	RW	0.001%	100-2000	100	
19.31	Select serial input for Line Speed reference	RW	Bit	-	0	
19.25	Line Speed reference Analogue format	RW	PU	0-32767	0	
18.23	Gear ratio	RW	0.01	100-32767	100	
18.18	Material gauge	RW	µm *(0.001ins)*	1-32767	1	
18.21	Motor base Speed		r/min	1-32767	1	
18.22	Motor base Power	RW	0.1kW (*0.1hp)*	1-32767	1	
19.14	Thread/Inch speed	RW	m/min *(ft/ min)*	0-18.29	1	
20.28	Watch dog enable	RW	Bit	0-1	0	
19.47	Select Torque Memory mode	RW	Bit	0-1	0	
19.50	Enable Speed Boost	RW	Bit	0-1	0	
20.20	Watchdog Clock Time	RW	0.01s	0-32767	0	
20.21	Watchdog trip delay	RW	0.1s	0-32767	0	
20.27	Select encoder line speed reference	RW	Bit	0 -1		
20.29	Line encoder time base	RW	millisecs	10-10000	100	
20.30	Line encoder RPM	RW	RPM			
20.31	Enable Slack Web detection	RW	Bit	-		
20.32	Slack Web detection threshold	RW	0.1%	1 - 1000		
19.04	Final Speed Reference	RO	0.1m/min *(0.1ft/min)*	0-32767	-	
18.04	Line Speed	RO	0.1m/min *(0.1ft/min)*	0-18.29	-	
18.05	Winder Speed	RO	r/min	0-32767	-	
18.06	Motor Speed	RO	r/min	0-32767	-	
19.46	Speed reference polarity	RO	Bit	-	-	
18.46	Web break error flag	RO	Bit	-	-	
18.49	Watch dog trip	RO	Bit	-	-	

12.3.2 Diameter

No.	Description	Type	Units	Range	Default	Setting
18.16	Minimum diameter	RW	mm *(0.1ins)*	1-32767	1	
18.17	Maximum diameter	RW	mm *(0.1ins)*	18.16-32767	1	
18.35	Select direct measurement of diameter via analogue input	RW	Bit	-	0	
19.23	Preset Diameter Analogue format	RW	PU	1-32767	1	
70.57	Analogue diameter signal min. value	RW	PU	0 – [70.58]	0	
70.58	Analogue diameter signal max. value	RW	PU	[70.58] -32000	32000	
19.40	Select Diameter Set Point from parameter 19.11 or 19.12	RW	Bit	-	0	
19.11	Preset diameter value 1 19.35 = 0	RW	mm *(0.1ins)*	18.16-18.17	1	
19.12	Preset diameter value 2 19.35 = 1	RW	mm *(0.1ins)*	18.16-18.17	1	
18.38	Preset diameter command bit	RW	Bit	-	0	
18.44	Diameter Calculation Mode	RW	Bit	-	0	
19.41	Reverse direction of diameter change under Lap or Traverse	RW	Bit	-	0	
19.43	Select Traverse mode for diameter calculation	RW	Bit	-	0	
19.42	Signal Traverse reversal	RW	Bit	-	0	
19.37	Hold diameter command bit	RW	Bit	-	0	
18.11	Diameter Hold function speed threshold	RW	r/min	1-32767	1	
19.32	Select fixed diameter slew limit	RW	Bit	-	0	
19.13	Fixed value for Diameter slew rate	RW	µm/s *(0.001ins/s)*	1-32767	1	
20.36	Slew hold diameter threshold	RW	µm/s *(0.001ins/s)*	1 - 32767	200	
20.22	Winder Speed Sample Time	RW	ms	10-10000	10	
20.33	Acquire multiplier	RW	0.1 %	1 - 1000	1	
20.34	Enable acquire on start	RW	Bit	-	0	
20.35	Enable acquire	RW	Bit	-	0	
20.31	Enable Slack Web detection	RW	Bit	-	0	
20.32	Slack Web detection threshold	RW	0.1%	0 - 1000	0	
18.01	Current Diameter display	RO	mm *(0.1ins)*	18.16-18.17	-	
18.02	Preset diameter value	RO	mm *(0.1ins)*	18.16-18.17	-	
18.09	Diameter Hold Flag	RO	Bit	-	-	
18.45	Diameter calculation error flag	RO	Bit	-	0	
19.07	Calc. Diameter before slew	RO	mm 0.1”	0 – 32767	-	
19.08	Actual Slew rate limit Applied	RO	Microns/ sec	0 – 32767	-	

12.3.3 Speed Parameters

No.	Description	Type	Units	Range	Default	Setting
18.32	Speed Mode select	RW	Bit	0-1	0	
18.31	Select Dancer or Load cell operation	RW	Bit	0-1	0	
19.24	Load cell/Dancer feedback	RW	PU	0-32767	0	
19.20	Dancer Position Set point	RW	PU	0-32767	0	
18.24	Centreing Window	RW	PU	0-32767	0	
19.29	Centreing Speed	RW	m/min *(ft/min)*	0-18.29	0	
19.28	Centreing Acceleration	RW	cm/min/s *(ins/min/s)*	0-32767	0	
19.44	Coupling Enable	RW	Bit	0 - 1	0	
20.40	Coupling speed reference	RW	R/min	0 – 10		
70.41	Coupling current limit	RW	%	0 - 1000	1000	
18.47	Web Tensioned Flag	RO	Bit	0-1	-	
18.03	Required tension as per unit value use for E/P output	RO	PU	0-32767	-	

12.3.4 Torque Parameters

No.	Description	Type	Units	Range	Default	Setting
18.32	Speed Mode select	RW	Bit	0-1	0	
18.12	Offset speed	RW	m/min *(ft/min)*	0–32767	0	
18.07	Actual Tension	RO	N *(lbf)*	0–18.30	-	
18.08	Tension feed forward	RO	N *(lbf)*	0-32767	-	
19.01	Tension torque component	RO	Nm *(lb.ft)*	0-32767	-	

12.3.5 Tension

No.	Description	Type	Units	Range	Default	Setting
18.30	Maximum Tension	RW	N *(lbf)*	1-32767	1	
18.13	Percentage of Tension applied as Stall Tension	RW	%	0-100	0	
18.34	Set stall tension as percentage of Maximum tension	RW	Bit	-	0	
18.37	Select condition which switches from Stall to Run tension	RW	Bit	0-1	0	
19.38	Select Tension Set Point from parameter 19.26	RW	Bit	-	0	
19.21	Tension reference Analogue format	RW	PU	0-32767	0	
19.26	Tension Set point (Digital)	RW	N *(lbf)*	0-18.30	0	
19.18	Tension reference ramp time	RW	s	0-32767	1	
18.40	Hyperbolic Taper select	RW	Bit	0		
19.39	Select Taper set Point from parameter 19.27	RW	Bit	0	0	
19.22	Taper reference Analogue format	RW	PU	0-32767	0	
19.27	Taper Set point (Digital)	RW	%	0-100	0	
19.17	Diameter at which Taper Tension will start	RW	mm *(0.1ins)*	18.16-18.17	1	
19.09	Final Tension reference Before taper	RO	N	0-Max tension		
19.10	Initial Tension reference after taper	RO	N	0-Max tension		

12.3.6 PID

No.	Description	Type	Units	Range	Default	Setting
19.24	Load cell / Dancer feedback	RW	PU	0-32767	0	
18.14	PID control P gain	RW	0.001Kp	0-32767	0	
18.15	PID control I gain	RW	0.1Ki	0-32767	0	
18.19	PID D Gain	RW	0.1Kd	0-32767	0	
18.25	PID Filter	RW	-	0-32767	0	
18.20	Limit on PID output	RW	Tension-% Speed–cm/min *(0.01ft/min)*	0-1000 0-32767	0	
18.41	PID Enable	RW	Bit	-	0	
18.42	PID Hold integral	RW	Bit	-	0	
18.43	PID Reset integral	RW	Bit	-	0	
19.03	PID error	RO	TorquePU Speed pos	+/-1000 -32768 to +32767	-	
19.06	PID Output	RO	Torque–0.1% Speed–cm/min *(0.01ft/min)*	0-18.20	-	

12.3.7 Compensation

No.	Description	Type	Units	Range	Default	Setting
04.10	Compensation Enable *(Torque Offset enable)*	RW	Bit	-	0	
18.48	Select Loss Profiler Compensation	RW	Bit	-	0	
18.26	Material width	RW	mm *(ins)*	1-32767	1	
18.27	Material density	RW	$kgms/m^3$ *(lb/ft^3)*	1-32767	1	
18.28	Mandrel inertia	RW	kgm^2 *($lb.ft^2$)*	0-32767	0	
19.19	Motor inertia	RW	kgm^2 *($lb.ft^2$)*	0-32767	0	
19.15	Friction loss	RW	0.1%	0-1000	0	
19.16	Viscous loss	RW	0.1%	0-1000	0	
19.45	Select acceleration signal	RW	Bit	-	0	
20.23	Analogue Line speed signal acceleration sample time	RW	10ms	1-100	1	
70.70-70.79	Loss Profiler Speed Parameters	RW	r/min	+/- 01.06	0	
71.70-71.79	Loss Profiler % Loss Torque Parameters	RW	%	0-1000 (0-100.0)	0	
19.05	Acceleration rate	RO	m/min/s *(ft/min/s*	-32768 to +32767	-	
19.02	Compensation torque	RO	Nm *(lb.ft)*	-32768 to +32767	-	
70.55	Loss Profiler Pointer	RO	-	0-10	-	

13 Documentation Reference

Manual Description	CT Part Number
Unidrive-SP User Guide	0471 - 0000
Unidrive-SP Advanced User Guide	0447 – 0002-XX
SM-DeviceNet	0471-0009
SM-PROFIBUS-DP	0471-0008
SM-Applications	0471-0007
SM-I/O Plus	0471-0006
SM-Universal Encoder Plus	0471-0005