SIEMENS

SIMATIC 505

TurboParison Module

User Manual

Order Number: PPX:505–8118–3
Manual Assembly Number: 2586546–0069
Third Edition

DANGER

DANGER indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.

DANGER is limited to the most extreme situations.

WARNING

WARNING indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury, and/or property damage.

CAUTION

CAUTION indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury, and/or damage to property.

CAUTION is also used for property-damage-only accidents.

MANUAL PUBLICATION HISTORY

SIMATIC 505 TurboParison Module User Manual
Order Manual Number: PPX:505–8118–3

Refer to this history in all correspondence and/or discussion about this manual.

Event	Date	Description
Original Issue	11/91	Original Issue (2591795–0001)
Second Edition	09/93	Second Edition (2591795–0002)
Third Edition	06/95	Third Edition (2591795–0003)

LIST OF EFFECTIVE PAGES

Pages	Description	Pages	Description
Cover/Copyright	Third		
History/Effective Pages	Third		
iii — xi	Third		
1-1 — 1-9	Third		
2-1 — 2-12	Third		
3-1 — 3-17	Third		
4-1 — 4-18	Third		
5-1 — 5-22	Third		
6-1 — 6-16	Third		
7-1 — 7-11	Third		
A-1 — A-6	Third		
B-1 — B-11	Third		
C-1 — C-3	Third		
D-1 — D-15	Third		
E-1 — E-4	Third		
Index-1 — Index-5	Third		
Registration	Third		

Contents

List of Figures

List of Tables

Preface

This manual shows you how to install and operate the SIMATIC® 505 TurboParison® Module (PPX:505–5103).

Other Manuals

Refer to the manuals listed below for instructions on installing, programming, and troubleshooting your Series 505™ controller and I/O.

- *SIMATIC 545 System Manual* (PPX:545–8101–x)
- *SIMATIC 500/505 Programming Reference Manual* (PPX:505–8104–x)
- *SIMATIC 505 TISOFT™ User Manual* (PPX:TS505–8101–x)

Agency Approvals

This module meets the standards of the following agencies:

- Underwriters Laboratories, Inc. UL Listed (Industrial Control Equipment)
- Canadian Standards Association: CSA Certified (Process Control Equipment)
- Factory Mutual Approved; Class I, Div. 2 Hazardous Locations
- Verband Deutscher Elektrotechniker (VDE) 0160 Clearance/Creepage for Electrical Equipment (Self-Compliance)

Series 505 products have been developed with consideration of the International Electrotechnical Commission standard (1131–2) for programmable controllers. For a list of the latest standards to which Series 505 complies, contact your Siemens Industrial Automation, Inc., distributor or sales office.

Telephoning for Assistance

If you need information that is not included in this manual, or if you have problems using the TurboParison module, contact your Siemens Industrial Automation, Inc., distributor or sales office. If you need assistance in contacting your U.S. sales office, call 1–800–964–4114.

Chapter 1

Product Overview

1.1 Features

Description

The TurboParison module controls the wall thickness of parisons created by blow-molding machines. This module provides closed-loop control for both continuous extrusion machines and accumulator machines.

The TurboParison module:

- Operates as a special function module that you can use either with any Series 505 controller (for example: models 535, 545, and 555) or with models 560, 565 or 575, and a Series 505 remote base controller (RBC).
- Controls up to four independent profiles in time-based mode. By operating the module in high-speed mode you can execute a 256-step parison profile in as little as 0.5 seconds.
- Controls up to four independent profiles in position-based mode with one accumulator or up to two independent profiles with two accumulators when profile push-out is required.
- Provides closed-loop control of the shot speed for an accumulator.
- Provides up to 256 profile steps (zones) for each profile.
- Operates down to a one millisecond sample rate while providing closed-loop control on all four axes.
- Provides linear and curvilinear interpolation, with unlimited master points.
- Allows you to easily increase the number of profile steps and improve resolution without re-entering the profile data.
- Provides automatic weight control that maintains part weight both before and after profile modification.
- Provides automatic phase checking that quickly indicates whether a parison is placed properly in the mold.
- Allows you to operate a high-speed discrete output signal for each profile.

The TurboParison module has five analog inputs and four analog outputs. The module combines four of the analog inputs and four analog outputs with a software-resident, closed-loop controller to provide four independent closed-loop control axes. The module uses these axes to control either parison wall thickness or accumulator ram speed, depending on the module operation mode you select. See Figure 1-1.

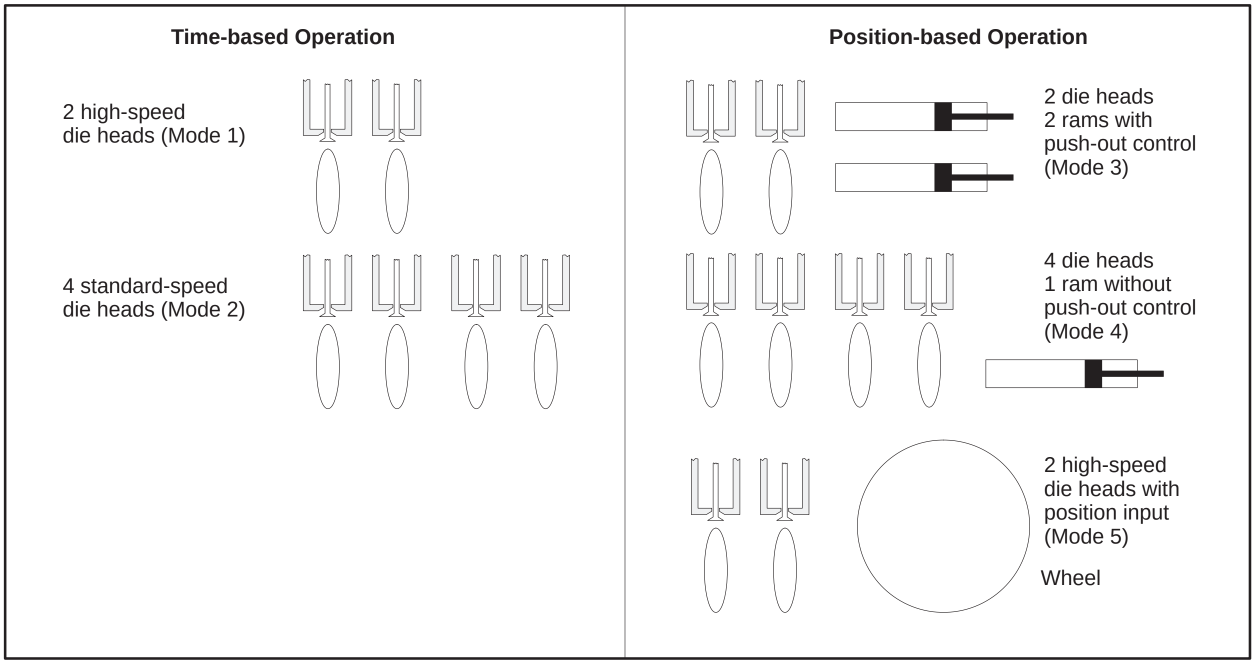


Figure 1-1 Modes of Operation for TurboParison Module

The module uses the auxiliary analog input (mode 4) to monitor accumulator ram position when the module does not control ram push-out control as well as to monitor position input (mode 5).

The remainder of this chapter describes the five operational modes and shows you how the blow-molding hardware connects to the module axes.

1.2 Time-based Operation

With time-based operation, a synchronized pulse triggers the start of a parison drop. Because a time-based machine extrudes continuously, the length of time between sync pulses determines the length of the parison. In time-based mode, you can control up to two die heads in high-speed mode, or up to four die heads in standard speed mode.

For a detailed description of time-based operation, refer to Chapter 4.

High-Speed Operation (Mode 1)

The high-speed mode allows you to control up to two independent die heads, each having its own profile of up to 256 program steps (zones). For a 256-step profile, a parison drop as fast as 512 milliseconds can be controlled. High-speed mode is used typically for wheel-type machines. See Figure 1-2.

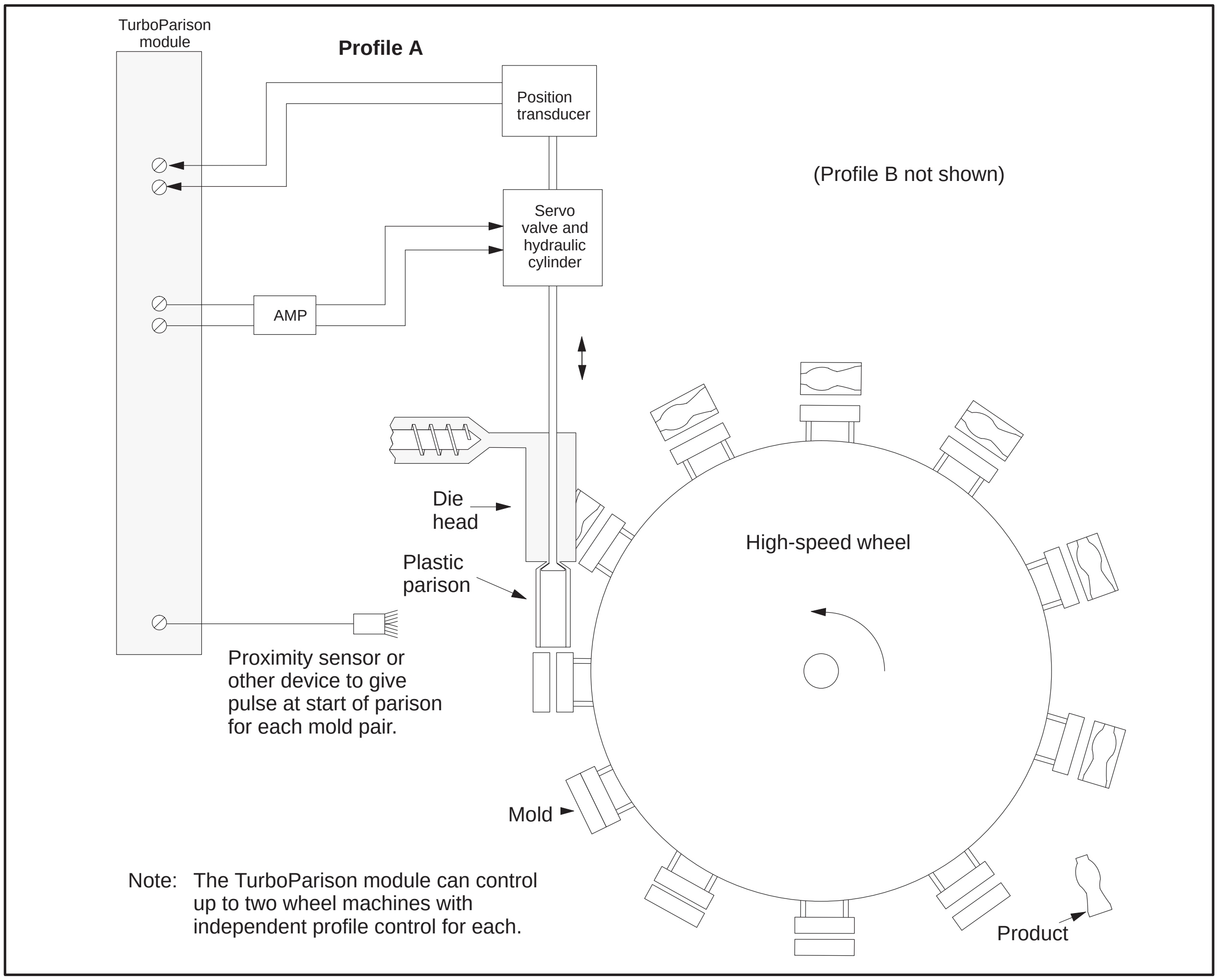


Figure 1-2 Example of High-Speed Operation

Standard-Speed Operation (Mode 2)

The standard-speed mode allows you to control up to four independent die heads, each having its own profile of up to 256 program steps. For a 256-step profile, a parison drop as fast as 1 second can be controlled. Standard-speed mode is ideal for most shuttle-type machines. See Figure 1-3.

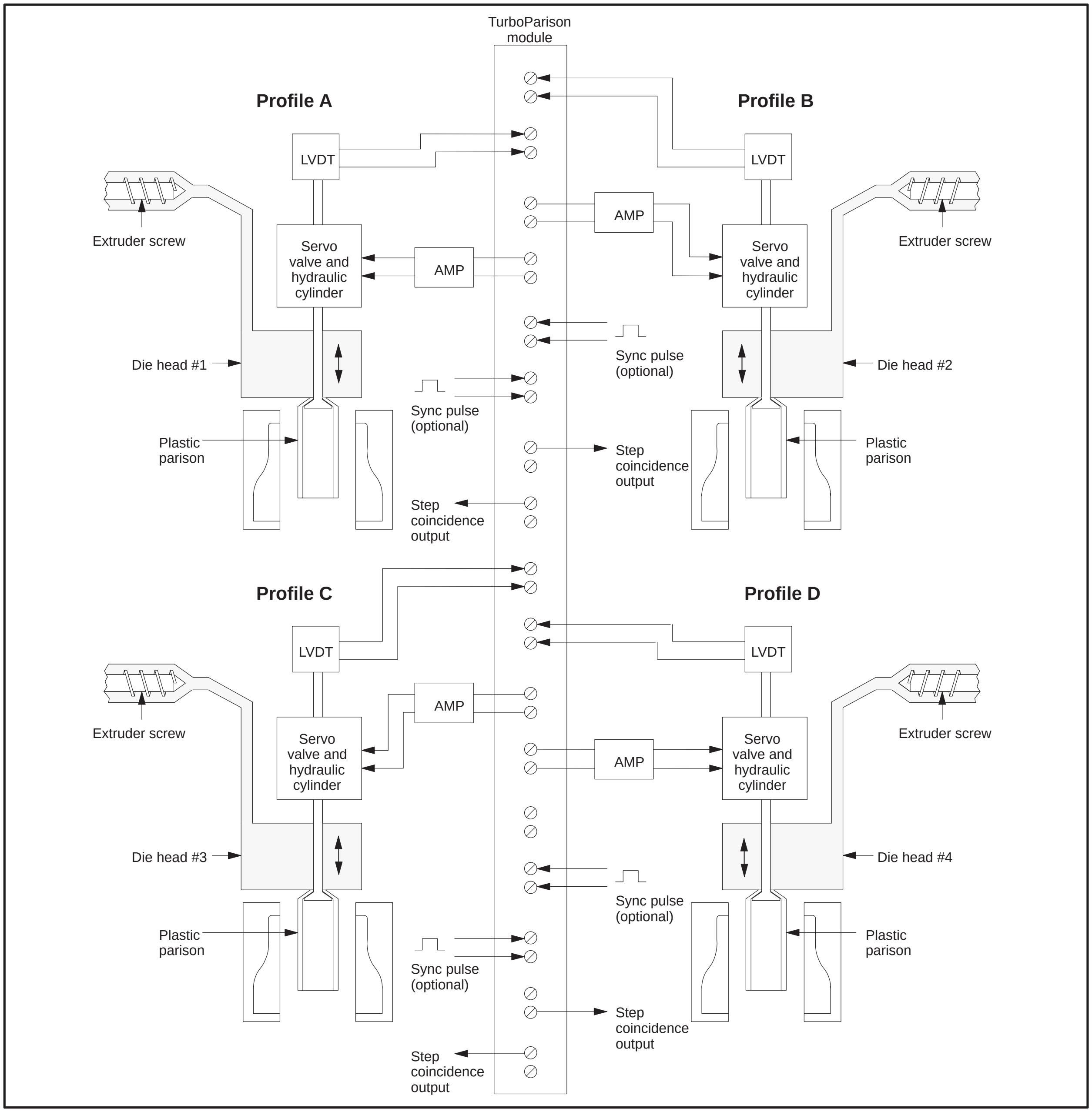


Figure 1-3 Example of Standard-Speed Operation

1.3 Position-based Operation

With position-based operation, the position of an accumulator ram or reciprocating screw sequences the execution of the die head profile. The die head profile determines the parison wall thickness, while the shot size determines the overall length of the parison. In position-based operation, you can select one of three modes, depending on whether or not closed-loop profiled push-out is required or you are using a wheel machine.

For a detailed description of position-based operation, refer to Chapter 5.

Two-Head Operation with Accumulator Control (Mode 3)

The two-head, two-accumulator mode allows you to control position-based parisons on two-head accumulator or reciprocating screw-type machines, each having its own independently controlled die head profile of up to 256 steps. In addition, this mode provides synchronized, closed-loop, profiled push-out for up to two accumulators or screws. Each accumulator can have its own velocity profile of up to 256 steps. Figure 1-4 shows a typical application of two-head/accumulator control.

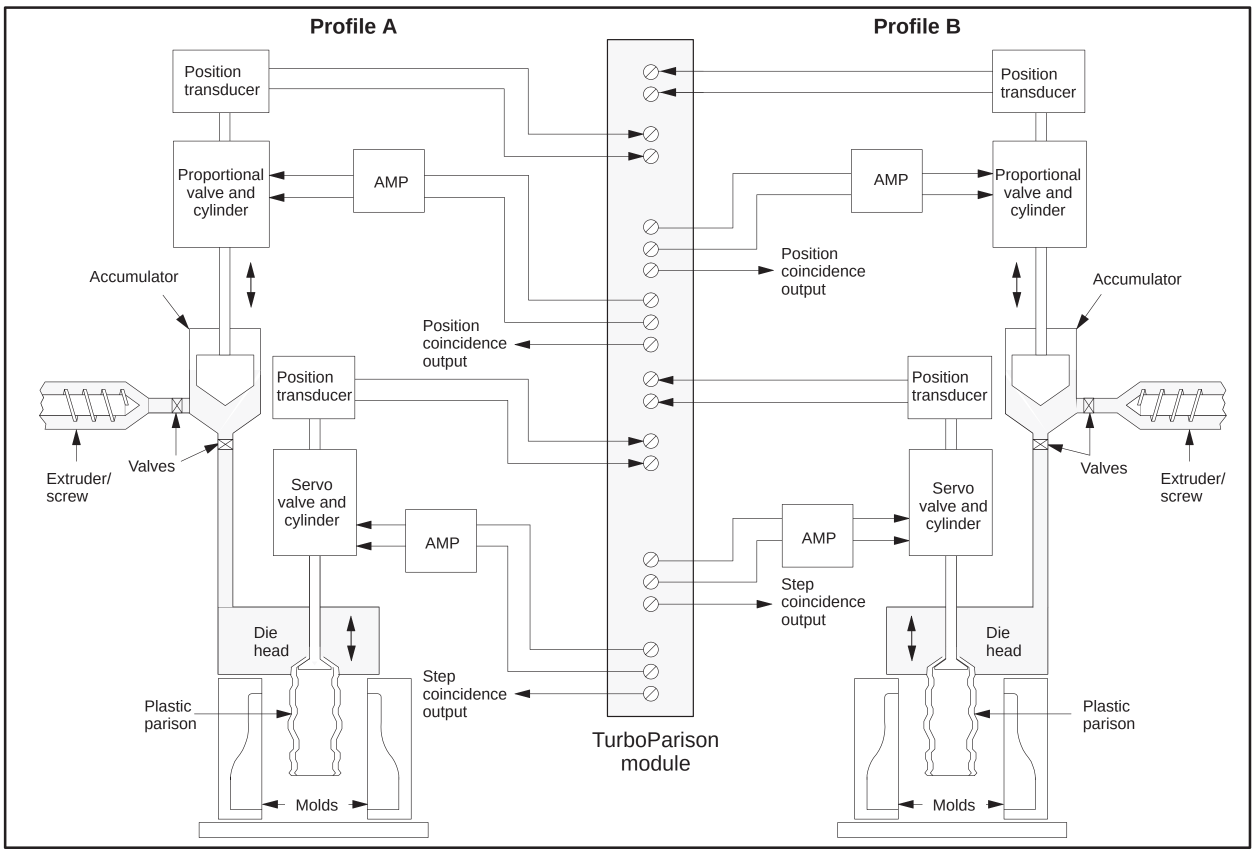


Figure 1-4 Example of Two-Head Operation with Accumulator Control

Four-Head Operation without Accumulator Control (Mode 4)

The single-accumulator mode allows you to control position-based parisons on four-head machines, each head having its own independently controlled profile of up to 256 steps. Although the module monitors the accumulator/screw position and sequences the execution of the profile, the module cannot control the motion of an accumulator/screw. Use analog I/O modules and controller logic to control the accumulator/screw motion. Figure 1-5 shows a typical application of four-head/no-accumulator control.

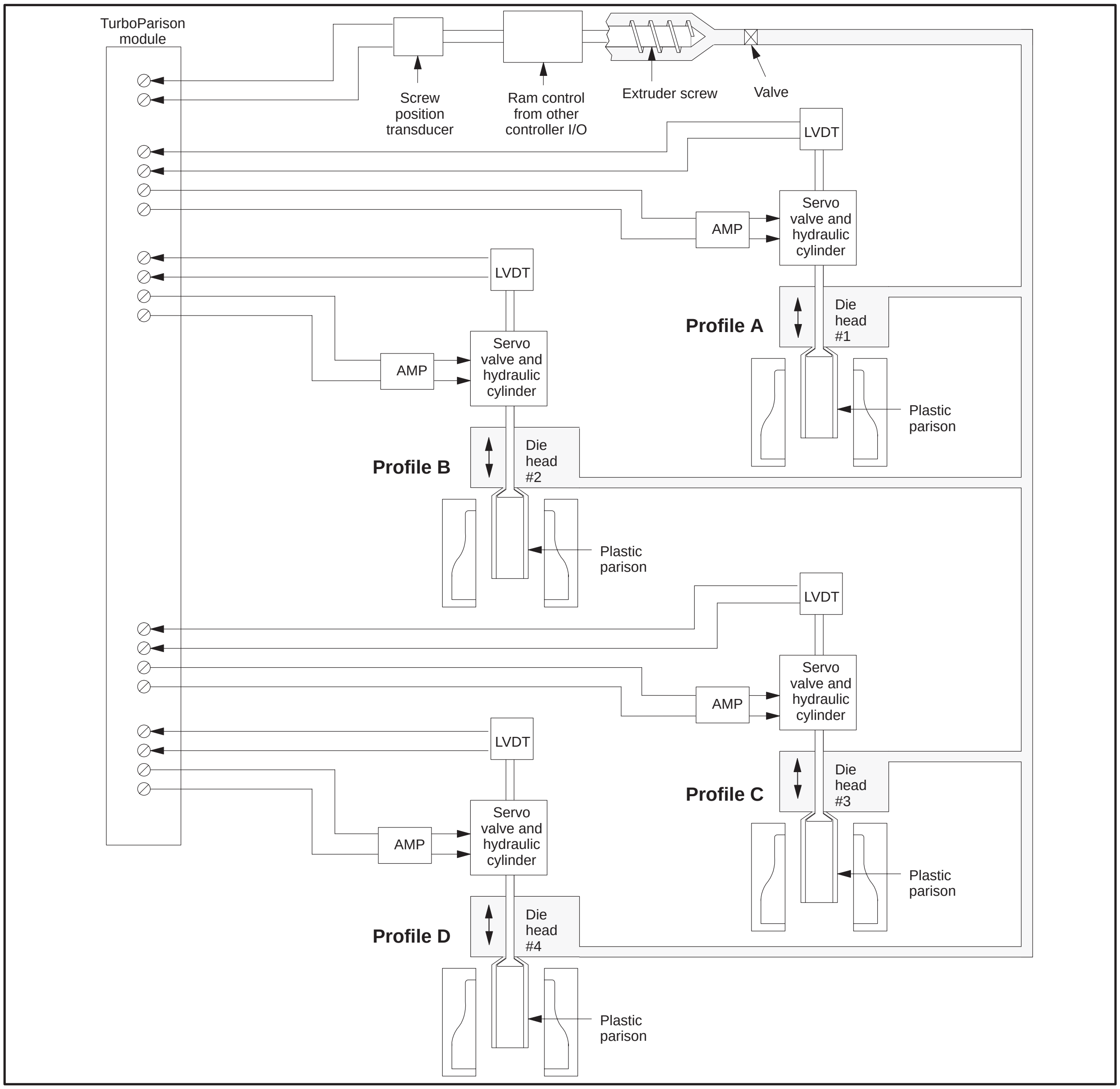


Figure 1-5 Example of Four-Head Operation without Accumulator Control

Position-based Operation (continued)

Wheel Machine Operation with Position Input (Mode 5)

Mode 5 allows control of one or two parisons on a high-speed wheel machine based on the position of the wheel. Automatic restart of the parison occurs when the ramp input indicates the start of the next mold. See Figure 1-6.

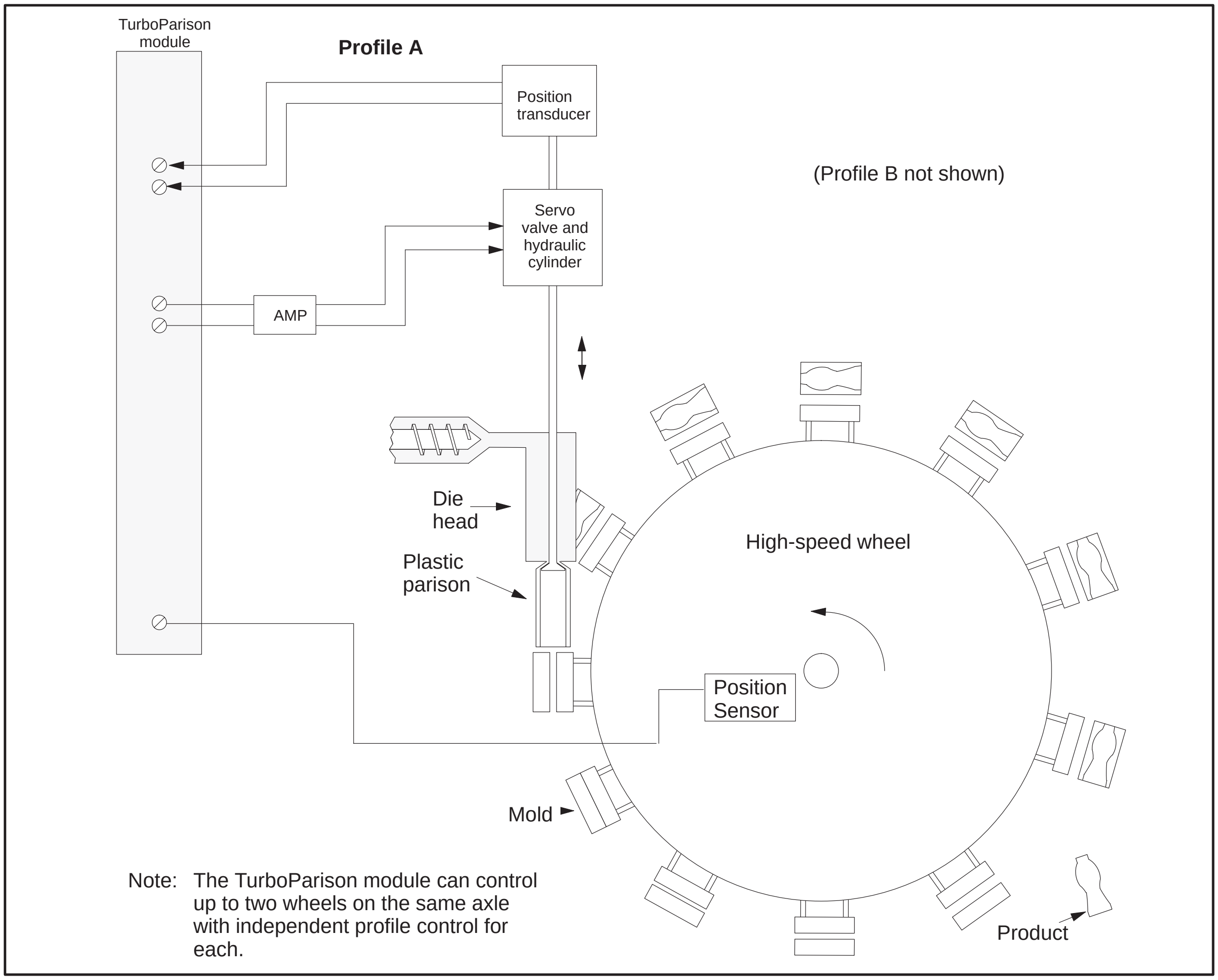


Figure 1-6 Example of High-Speed Operation with Position Input

1.4 Background Knowledge

Prerequisites and Assumptions

Before you begin to use the TurboParison module, ensure that the following prerequisites and assumptions are true.

- You understand the operation and programming of the 545/565 controllers.
- You understand how to use TISOFT to create and modify controller programs.
- You are familiar with the interaction of Operator Interface devices with the controller.
- You understand the operation of blow-molding machines and their associated hydraulic and electrical systems.

Figure 1-7 lists a sequence of tasks that we suggest you perform before trying to operate your machine with the TurboParison module.

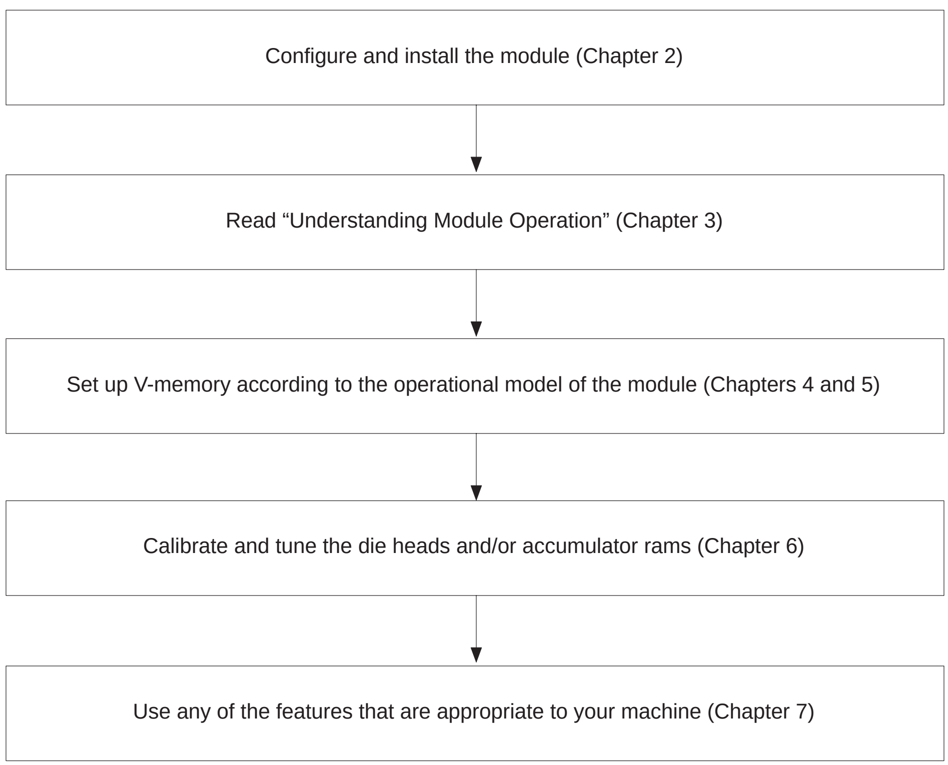


Figure 1-7 List of Setup Tasks

Chapter 2

Installing the Module

2.1 Overview of Installation

Flow of Tasks

Figure 2-1 shows the organization of the tasks described in this chapter.

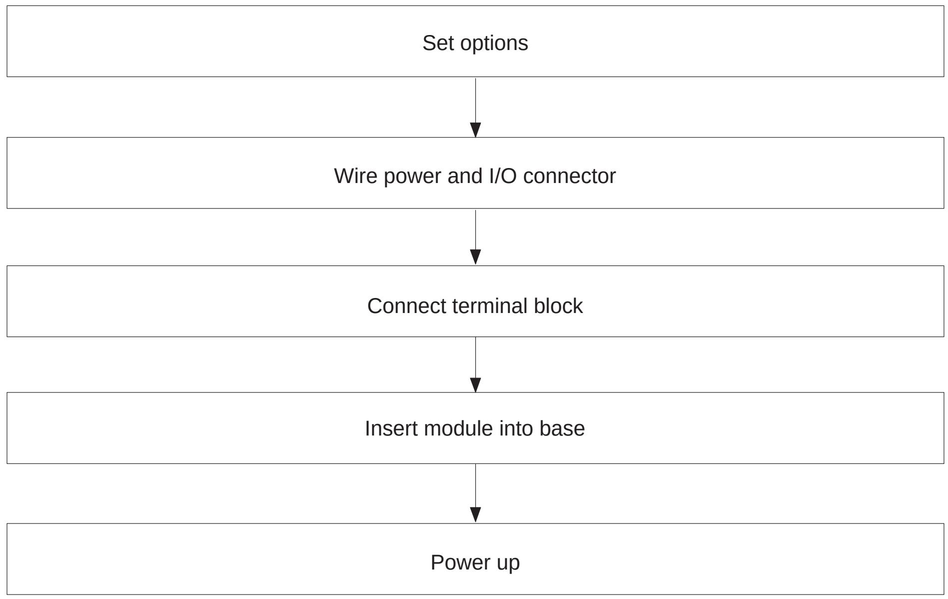


Figure 2-1 Flowchart of Installation

Handling the Module

Many integrated circuit (IC) devices are susceptible to damage by the discharge of static electricity. The suggestions listed below reduce the probability of damage to these devices whenever you handle a controller, a base controller, or any of the I/O modules.

Ensure that both the module and the person who handles the module are at the same ground potential. To accomplish this, fulfill the following conditions.

- Transport the module in an anti-static container or with anti-static material.
- Ensure that the work area has a conductive pad with a lead that connects it to a common ground.
- Ground yourself. Make contact with the conductive pad or wear a grounded wrist strap.

Visual Inspection

If there is any visible damage to the module, or if you need additional information and assistance, contact your Siemens Industrial Automation, Inc., distributor or sales office. If you need assistance in contacting your U.S. sales office, call 1–800–964–4114.

2.2 Setting Options

Selecting Module Operation Type

Use the dipswitch to set the module operational mode, listed in Table 2-1. The dipswitch assembly is labeled either **OFF** or **OPEN**. Either of these is equivalent to zero in Table 2-2. Figure 2-2 shows how to set the switch. Use a ball-point pen to set dipswitches.

Table 2-1 Operational Modes of Module

Mode	Description	Axis 1	Axis 2	Axis 3	Axis 4	Auxiliary input
1	Time-based, high-speed, 2 heads	Profile A die head	Profile B die head	Not used	Not used	Not used
2	Time-based, standard-speed, 4 heads	Profile A die head	Profile B die head	Profile C die head	Profile D die head	Not used
3	Position-based, 2 heads, 2 rams	Profile A die head	Profile B die head	Profile A ram	Profile B ram	Not used
4	Position-based, 4 heads	Profile A die head	Profile B die head	Profile C die head	Profile D die head	Ram
5	Position-based, high-speed, 2 heads	Profile A die head	Profile B die head	Not used	Not used	Position

Table 2-2 Dipswitch Settings for Operational Modes

Mode and description	Switch 1	Switch 2	Switch 3
1—Two high-speed time-based profiles	0	0	0
2—Four standard-speed time-based profiles	1	0	0
3—Two position-based profiles with accumulator control	0	1	0
4—Four position-based profiles no accumulator control	1	1	0
5—Two high-speed position-based profiles	0	0	1

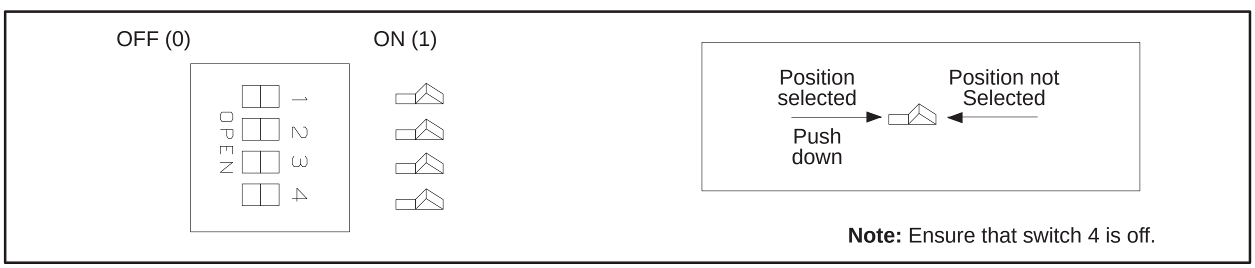


Figure 2-2 Setting Dipswitches

Selecting a Voltage Range

Figure 2-3 shows jumper locations for selecting a voltage range. Selectable voltage ranges for analog inputs are 0 to +5 VDC and 0 to +10 VDC (default). Selectable voltage ranges for analog outputs are 0 to ±5 VDC and 0 to ±10 VDC (default).

Figure 2-3 shows the locations of the dipswitches and jumpers.

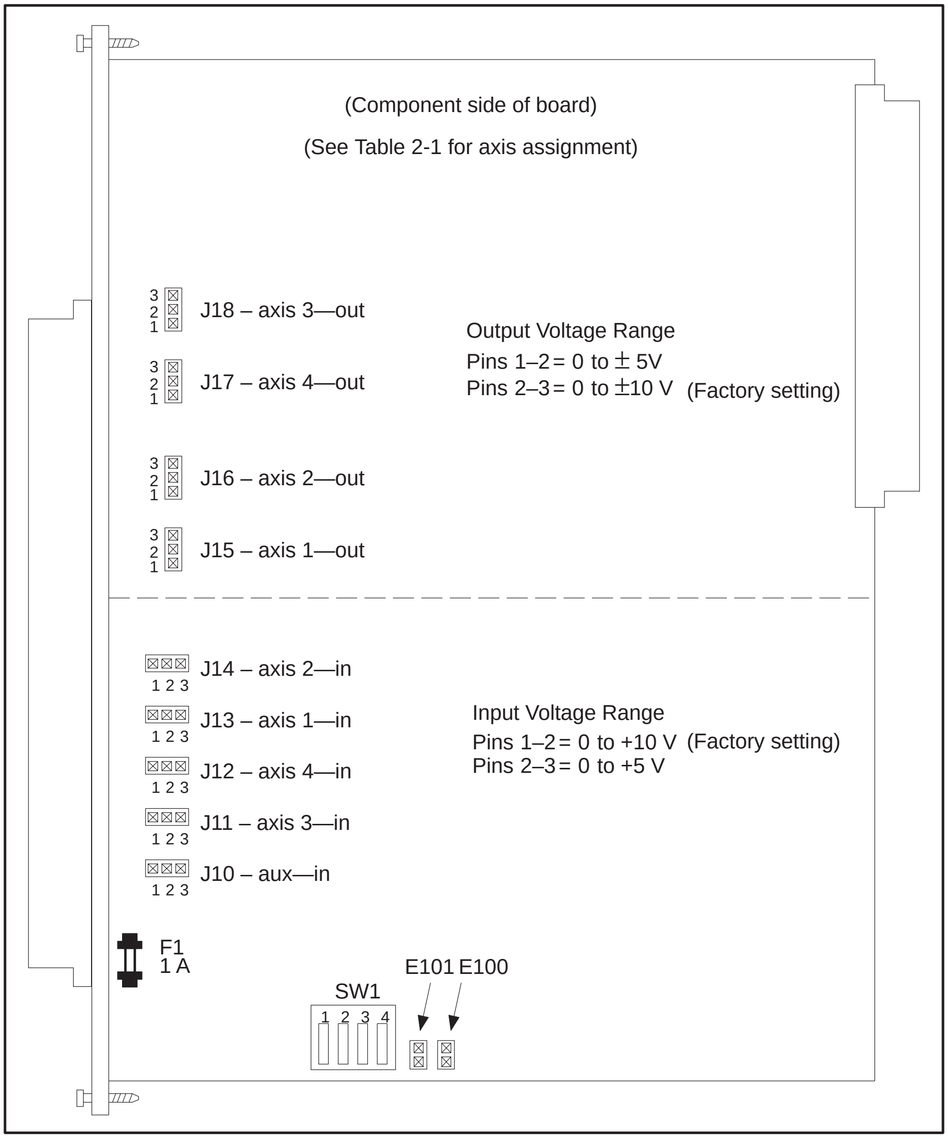


Figure 2-3 Dipswitch and Jumper Locations

NOTE: Jumper pins E100 and E101 are for manufacturing test purposes only. Do not attempt to install jumpers across them.

2.3 Field Wiring

Field wiring consists of wiring for the user-supplied power and wiring for the input or output signal. Keep the two types of wiring separate to prevent noise on the signal wiring. Use shielded, twisted-pair cable (14-24 AWG or 0.18–1.5 mm^2, either stranded or solid-type). See Figure 2-4 and Figure 2-5.

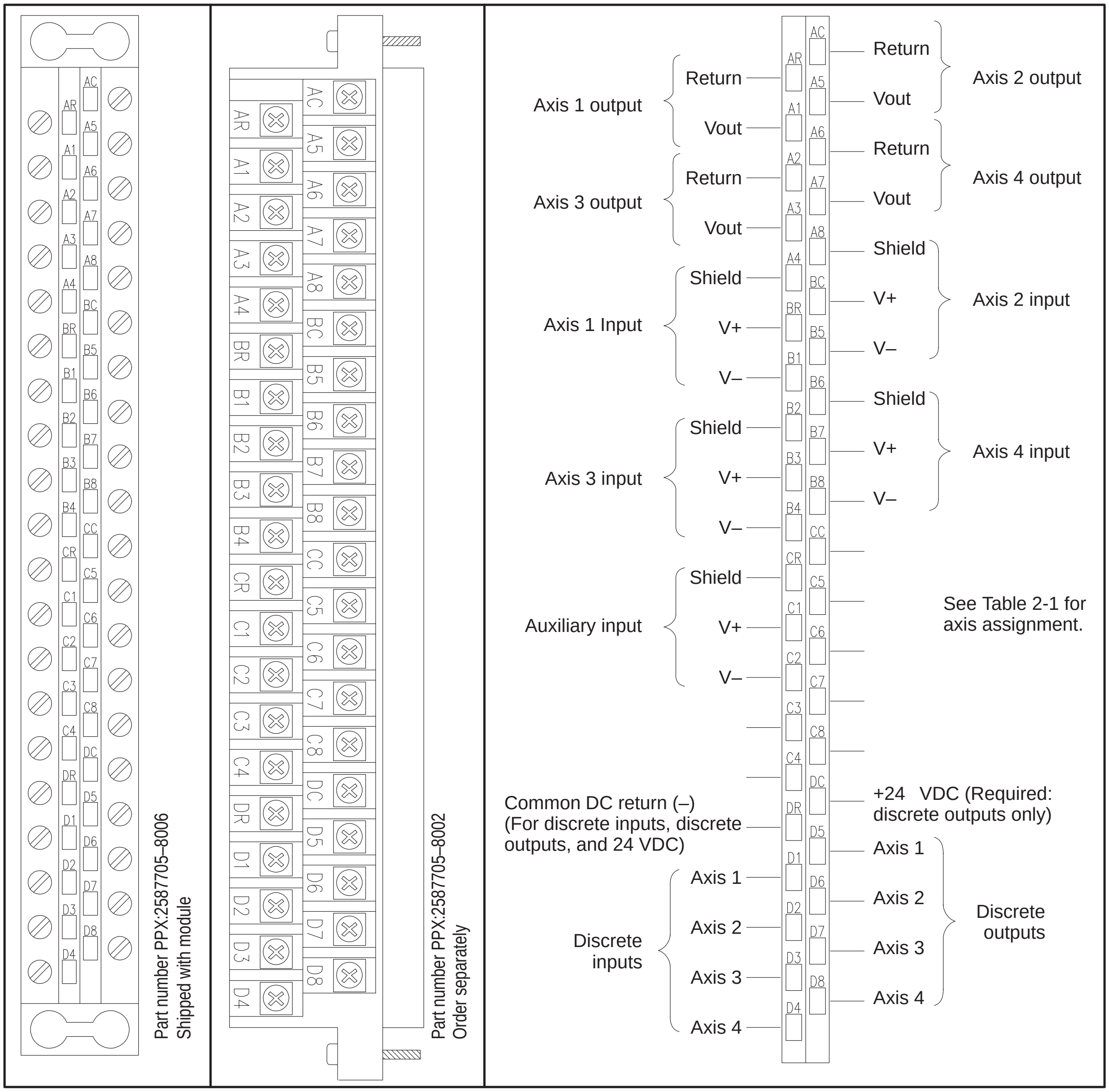


Figure 2-4 Terminal Blocks and Pinouts

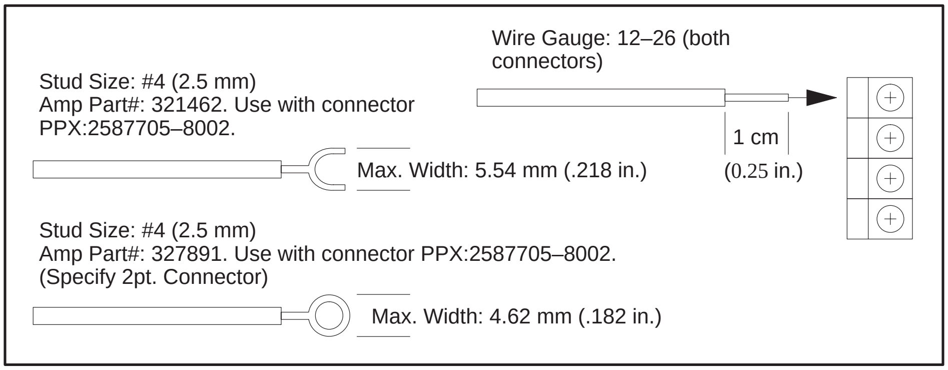


Figure 2-5 Wire Gauge and Stud Sizes

WARNING

Use supply wires suitable for at least 75°C. Signal wiring connected to this module must be rated at least 300 V.

Wiring that does not meet the requirements could cause death and/or serious injury or damage to equipment.

Ensure that your wire is suitable for at least 75°C, and that signal wiring connected to this module is rated at least 300 V.

Minimizing Noise

To minimize noise problems, follow these guidelines.

- Ensure that the controller power ground lug is wired to system ground.
- Use the shortest possible wires.
- Avoid placing signal wires parallel to high-energy wires. If the two must meet, cross them at right angles.
- Avoid bending the wire into sharp angles.
- Use wireways for wire routing.
- When you use shielded wires, ground shields at only one end for better noise immunity.
- Label the wires and place them so that they do not interfere with existing wiring.

2.4 Power Supply and Grounding Recommendations

Because of the high-speed update of the module, the amount of movement of the ram between module samples is very small, even on fast machines. This means that very small changes in the analog input signal must be accurately detected in order to perform smooth closed loop velocity control.

Special differential input stages have been installed in the module which provide extremely high common mode noise rejection. However, it is imperative that electrical noise, both direct and induced, on the inputs be kept below 0.05 mV. Use the following minimum guidelines.

- Provide a separate, highly-filtered power supply for the transducer exitation. This supply should be capable of furnishing 0 to +10 VDC at ±0.005% regulation and 0.250 mV ripple or better.
- Run twisted shielded wiring for all analog signals, including power supply connections. Then run all wiring in separate metallic conduit or flex that has been properly grounded with minimal exposed lengths at connection.
- Ground all shields at the module or amplifier input end as shown in Figure 2-6.

Power Budgeting

The module consumes 7 W of +5 VDC power from the base. Be sure that your system does not exceed the maximum power available from the 505 base power supply.

2.5 Cable Connections and Grounding

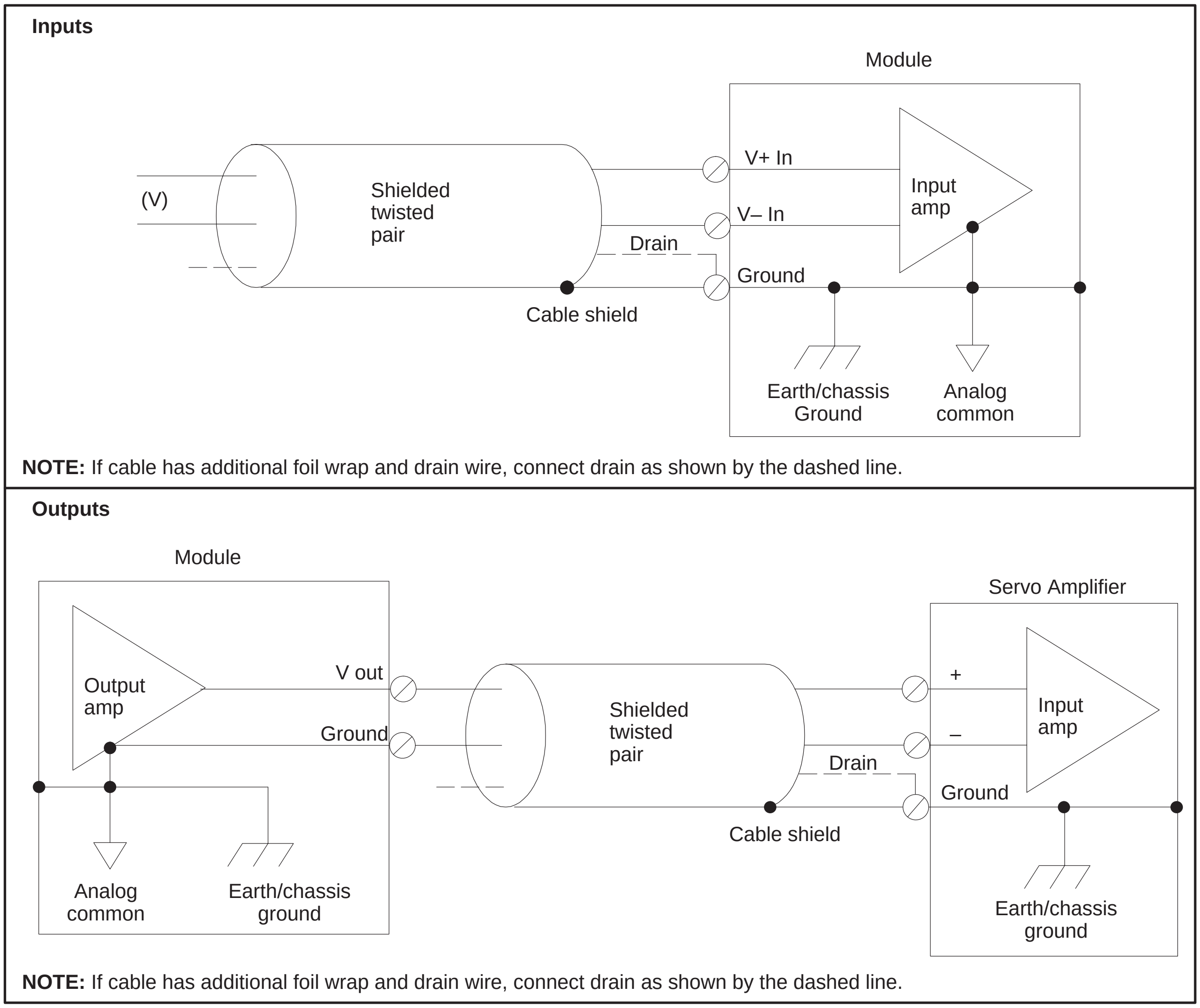


Figure 2-6 Module Input/Output Wiring

2.6 Inserting the Module into the Base

⚠ WARNING

To minimize risk of potential shock hazard, turn off power to the I/O base and to any modules installed in the base before inserting or removing a module or installing a terminal block.

Failure to do so may cause unexpected shock/equipment startup, which could result in death and/or potential injury to personnel or damage to equipment.

Ensure that power is turned off to the base and any modules installed in the base before you insert or remove a module or install a terminal block.

Inserting the Module

The TurboParison module is a single-wide module. Insert the module as shown in Figure 2-7, paying attention to the minimum torque required to help prevent noise. The module is a special function module and capable of high-speed block transfers. Install the module in the local base (the base containing the controller) for best performance.

Guidelines for CPU TI535

Do not install this module in slot one of any 505 base controlled by a 535 CPU. If you do install this module in slot one, discrete modules in base zero do not register in controller memory. If the controller is a 545 or 565, you can install the module in any slot of any base.

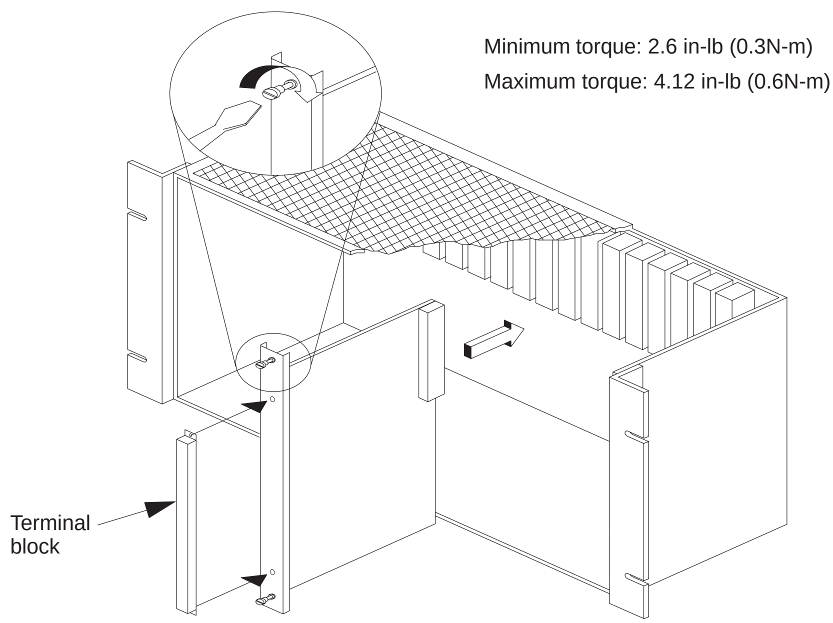


Figure 2-7 Inserting the Module into the Base

Checking Status Indicator

Within approximately three seconds of powerup, the MOD GOOD LED on the bezel comes on, indicating that the module is good. If the LED fails to come on, check your wiring. If the problem persists, contact your distributor.

NOTE: If LEDs blink, refer to Table 2-3. If any fail codes occur (except for the factory test jumper), the module should not be used.

Table 2-3 Module Fail Codes

Number of blinks Module Good LED	Error/Failure Condition
0	Module functioning normally
1	Analog/digital conversion
2	Timer failure
3	Internal ram failure (not used)
4	External ram (LSB and MSB)
5	External ram (LSB)
6	External ram (MSB)
7	SFIC ram
8	ROM checksum failure
9	Digital/analog conversion
10	Analog/digital conversion
Continuous*	Factory test jumper installed

* The Module Good and Run LEDs blink simultaneously if the factory test jumper is in place. To correct this problem, remove the shorting block from the two pins labeled E100 located near the bottom edge of the circuit board (see Figure 2-3).

If both LEDs blink alternately, a fatal error has occurred. Check the communication link between controller and module. If the problem persists, contact your distributor.

2.7 Logging the Module into Controller Memory

Configuring I/O

The TurboParison module has four 16-bit word inputs (WX) and four 16-bit word outputs (WY). When you configure controller I/O, you assign addresses to each of the eight words. The controller then references a word via the I/O address.

For example, if you configure the module so that its I/O address begins at 0001, you can reference the first word (an input word) with the address WX1, and the fifth word (an output word) with the address WY5. We refer to words WX1 – WX4 and WY5 – WY8 throughout this manual. If you assign an I/O address other than 0001 to the module, your WX/WY words will be different.

Refer to the *SIMATIC 500/505 Programming Reference Manual* or the *SIMATIC 505 TISOFT User Manual* for more information about configuring I/O.

Selecting the I/O Definition Chart

Figure 2-8 shows a sample I/O definition chart with a parison module installed in slot 2. Refer to your TISOFT manual for detailed instructions.

I/O MODULE DEFINITION FOR: CHANNEL . . . 1 BASE . . . 00						
	I/O	NUMBER OF BIT AND WORD I/O				SPECIAL
SLOT	ADDRESS	X	Y	WX	WY	FUNCTION
1	0000	00	00	00	00	NO
2	0001	00	00	04	04	YES
3	0009	00	00	00	00	NO
4	0000	00	00	00	00	NO
5	0017	00	00	00	00	NO

Figure 2-8 Sample I/O Definition Chart

Viewing the I/O Configuration Chart

Use SHOW or a similar TISOFT menu selection to display the I/O Configuration Chart. The configurations in Figure 2-8 appear as shown in Figure 2-9.

I/O CONFIGURATION CHART FOR CHANNEL . . . 1 BASE 00								
	I/O POINTS							
	1	2	3	4	5	6	7	8
SLOT 1								
SLOT 2	WX0001	WX0002	WX0003	WX0004	WY0005	WY0006	WY0007	WY0008
SLOT 3								
SLOT 4								

Figure 2-9 I/O Configuration Chart

Chapter 3
Understanding Module Operation

3.1 Introduction

This chapter describes overall module operation and how to configure the module for your application. Chapters 4 and 5 describe operation that is specific to time-based and position-based machines, respectively. If your application is time-based, you do not need to read the chapter about position-based applications, and vice versa.

The TurboParison module controls the parison wall thickness, and in some cases ram velocity, according to your configuration data and depending on the module mode. TurboParison is an intelligent module capable of machine control independent of direct supervision by the controller. The module is also a special function module that can do high-speed block transfers of data to and from the controller.

The module has five analog inputs and four analog outputs. The analog outputs and four of the analog inputs are combined with a software-resident, closed-loop controller to provide four independent closed-loop control axes. These axes are used to control either wall thickness or accumulator ram velocity, depending on the module operation mode you select (Figure 3-1). The fifth analog input is used to monitor either the position of an accumulator ram in Mode 4 or a wheel in Mode 5. Unused outputs can be used as general purpose analog outputs by placing the unused output(s) in Manual mode and moving the value to the manual override value location. Unused inputs can be used as general purpose analog inputs by reading their value from the general status table. This applies to all models.

Configuration information is stored in the controller battery-backed variable memory (V-memory). Communication between the module and the controller, illustrated in Figure 3-1, is provided in two ways.

- Four 16-bit WX input words report status and error information to the controller. Four 16-bit WY output words are used to control the module.
- V-memory data, e.g., configuration information, is transferred as high-speed block data transfers.

The module reads analog and discrete signals from the process through its onboard I/O points. The module sends analog output signals that typically drive a servo or proportional valve amplifier to control the mandrel position or accumulator ram velocity.

The module also has four discrete inputs and outputs used for various machine functions.

- The inputs are used for sync pulses in time-base mode, discussed in Chapter 4.

- The outputs are coincident outputs that may be triggered from either a profile step or the accumulator position, discussed in Chapter 7.

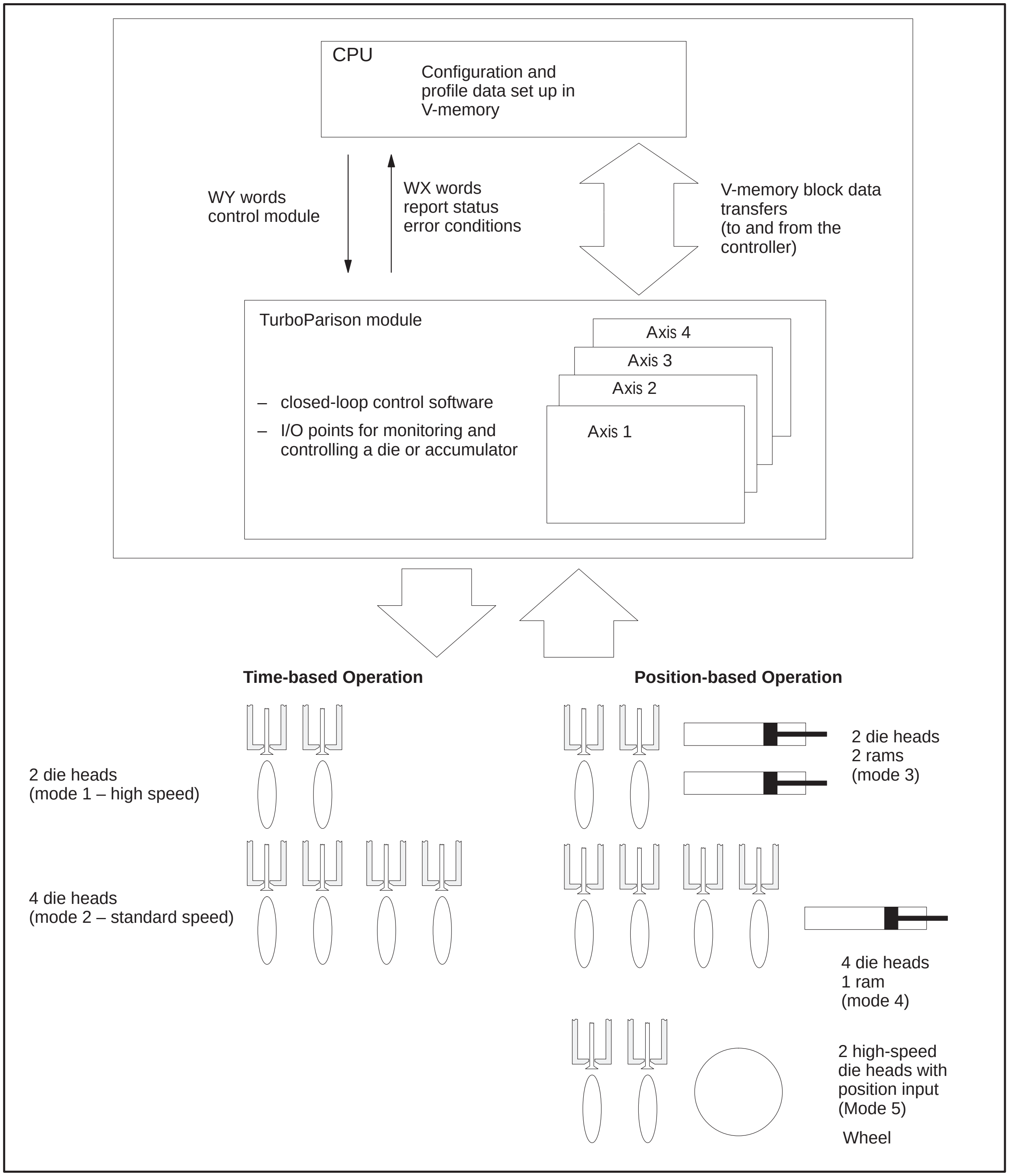


Figure 3-1 Relationship of TurboParison Module to the Machine

3.2 Communicating with the Controller

Overview

TurboParison is a special function module. The controller uses WX and WY words to report status and issue commands to the module. See Figure 3-2. TurboParison also has the capability to transfer blocks of V-memory, where configuration data and setpoint data are stored. Runtime status is updated in blocks to the controller.

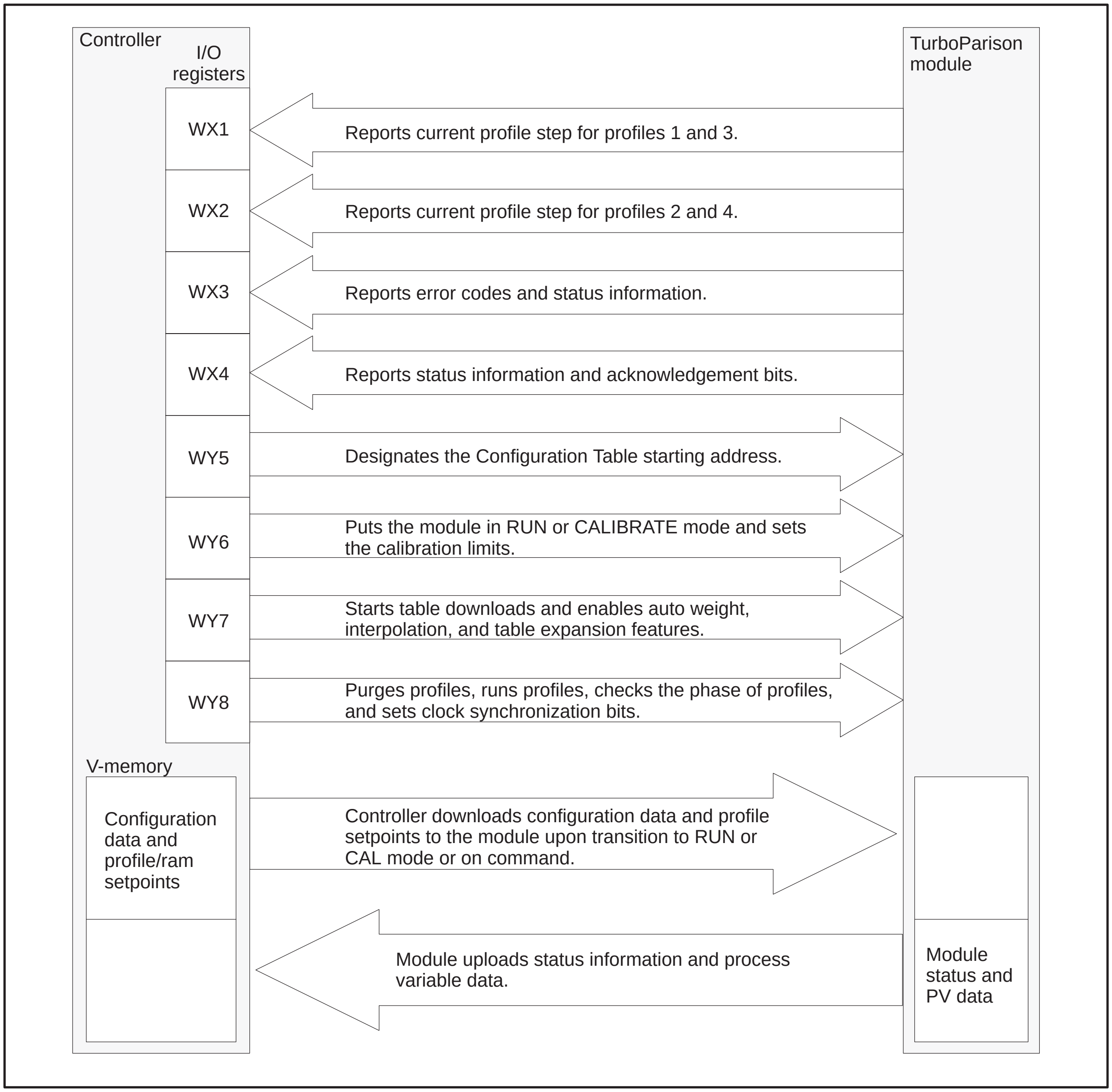


Figure 3-2 Controller/Module Information Exchange

WX/WY Words

The WX words report status and error information to the controller. The WY words are used by the controller to control the module operation. Figure 3-3 shows the bit layouts for the WX words. Figure 3-4 shows the bit layouts for the WY words. WY5 and WY6 must be set correctly to ensure that the module operates properly. Refer to Appendix A for detailed descriptions of the other WX/WY words.

WY5 V-Memory Address of Configuration Table

WY5 provides the starting address of the Configuration Table. The module reads the Configuration Table from the controller upon transition to RUN mode. Ensure that WY5 contains a valid V-memory address, and that configuration information exists at this location before going to RUN mode.

WY6 Module Operational Mode

Setting WY6 selects the mode of operation for the Module: IDLE, CALIBRATE, or RUN.

- IDLE – When all bits are equal to 0 (off), the module is idle, outputs are turned off.
- CALIBRATE – When Bit 13 is equal to 1, the module enters calibration mode. Use Bits 14-16 to store calibration data (Zero, Span, ram velocity) into temporary storage. Resetting Bit 13 to 0 loads calibration data into the appropriate V-memory locations.

NOTE: When you exit CALIBRATE mode (by changing WY6 Bit 13 to 0), the module goes to either IDLE or RUN mode, as determined by the value of WY6. See Figure 3-2.

- RUN – When Bits 2 and 4 are equal to 1 and all other bits equal to 0 (hexadecimal 5000, decimal 20480), the modules enters RUN mode. All setpoint tables and configuration information is automatically downloaded from the controller. All axis controllers are enabled, the RUN LED comes on, and the RUN mode bit (WY4, Bit 8) is set to 1.

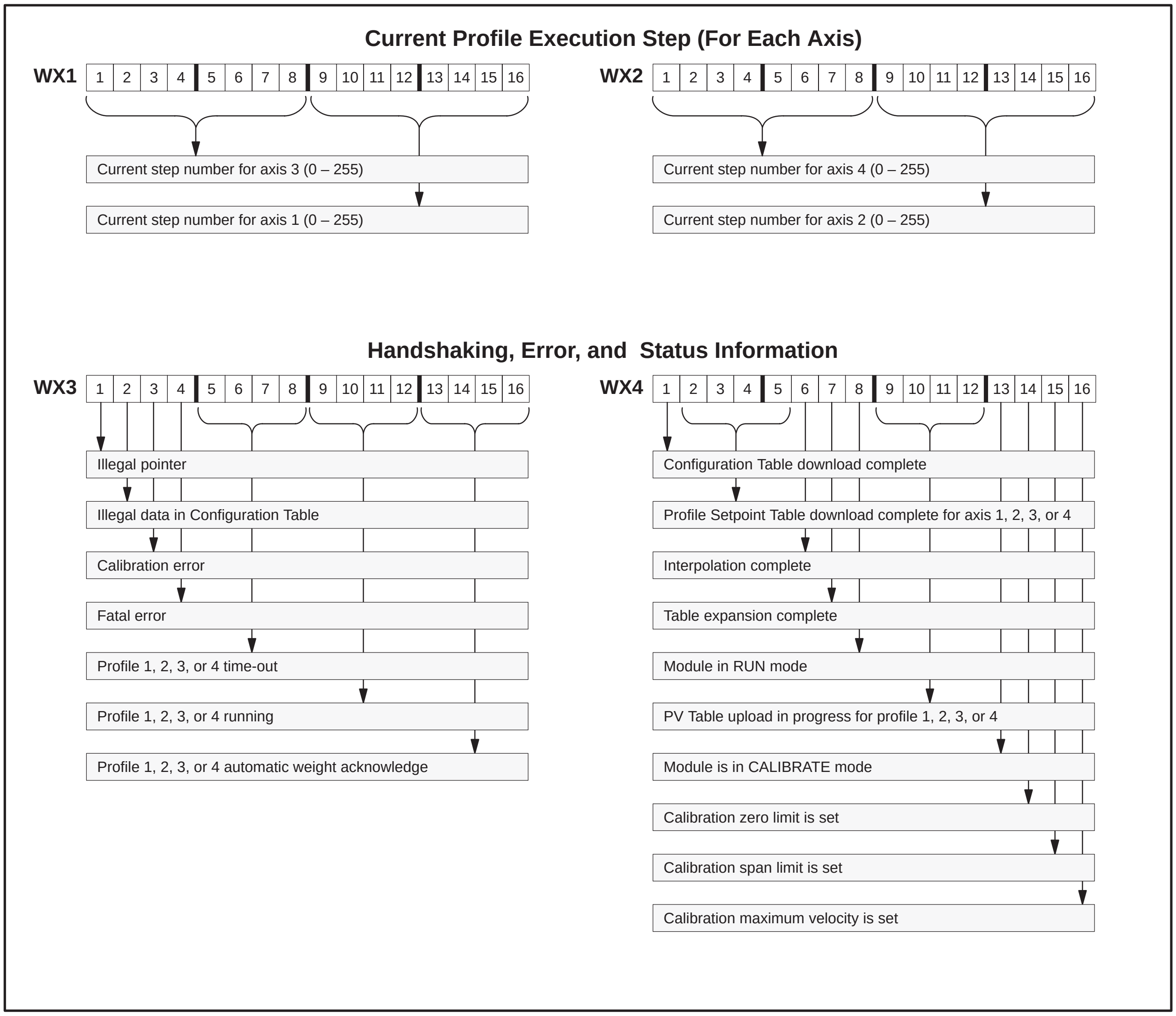


Figure 3-3 Bit Layouts for WX Words (Data from Module)

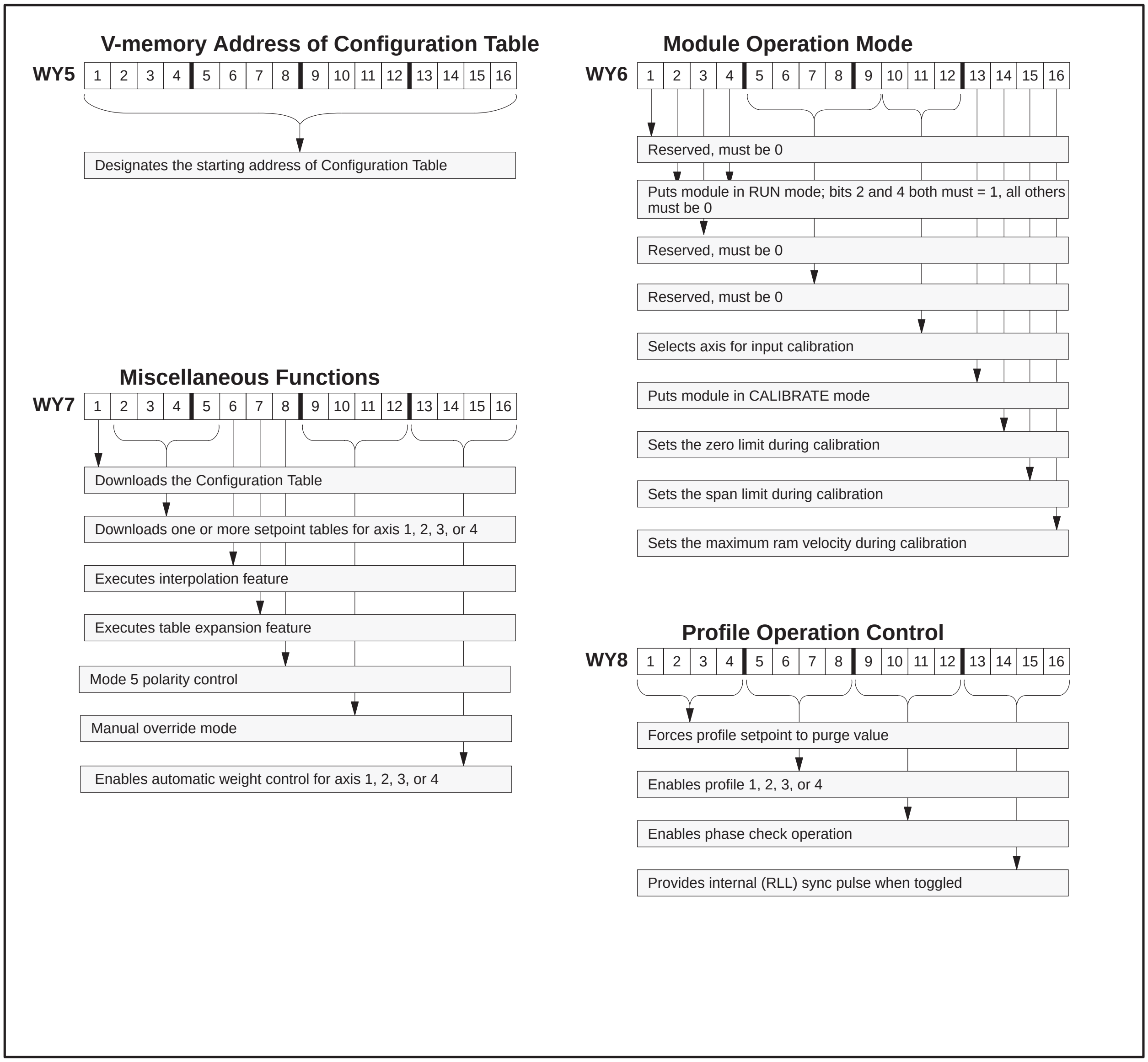


Figure 3-4 Bit Layouts for WY Words (Commands to Module)

V-Memory Block Transfers

TurboParison module uses high-speed block transfers to exchange both configuration and runtime status with the controller. See Figure 3-5.

Configuration Table

The module configuration is stored in a section of V-memory called the Configuration Table. This table holds configuration information for each control axis, pointers to other tables that reside in V-memory, and other operational information. WY5 must contain the starting address of the Configuration Table (Figure 3-5). The Configuration Table is automatically downloaded to the module upon transition to RUN or CALIBRATE mode. If configuration information is changed, the table must be downloaded again before the changes will take affect. See Section 3.4.

General Status Table

Runtime status is reported by the module (typically once every controller scan) to a block of V-memory directly following the Configuration Table. This block is called the General Status Table, and is located at WY5 + 200. The table contains I/O status for each control axis, profile execution status and other information. For more information, see Appendix C.

Setpoint Tables

Each control axis has a table of Profile Setpoint Table associated with it. The starting address is specified in the Profile Setpoint Table starting address field of the Configuration Table (see Appendix B). Setpoint data is stored in these tables and downloaded to the module. The Setpoint Tables are automatically downloaded to the module upon transition to RUN mode. If setpoint data is changed, the table must be downloaded again before the changes will take affect. See Section 3.4.

Process Variable Tables

Normally each control axis has a Process Variable Table associated with it (except in mode 3, when axis is used for accumulator control). The starting address is specified in the Process Variable Table starting address field of the Configuration Table (see Appendix B). When executing a profile the module saves the last process variable attained before transitioning to the next setpoint. This data is collected by the module during profile execution. Upon completion of profile execution the data is transferred to the Process Variable Table in the controller. See Section 3.4.

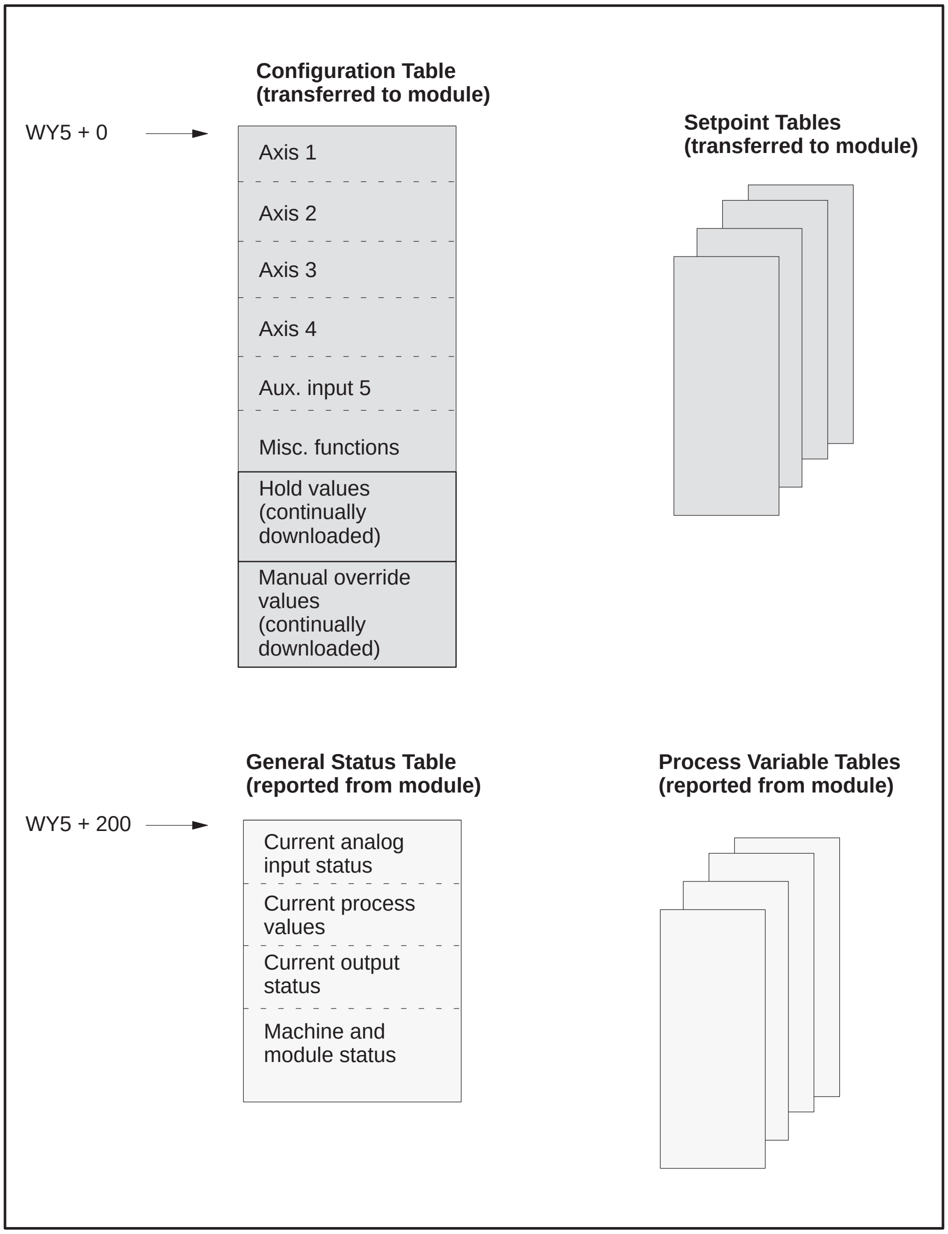


Figure 3-5 V-Memory Transfer of Configuration and Status

3.3 Operating the Module

The TurboParison module controls the wall thickness of a parison by adjusting the position of the mandrel in the die bushing. You create a table of values that correspond to each position of the mandrel, called the Profile Setpoint Table. This table can consist of up to 256 profile steps. The module uses the data in this table in conjunction with configuration information, execution status, and other commands to determine the correct setpoint to be passed to the axis controller. The axis controller determines the appropriate signals to send to the die head servo amplifier, based on the configuration options selected, current setpoint and feedback signal (Figure 3-6).

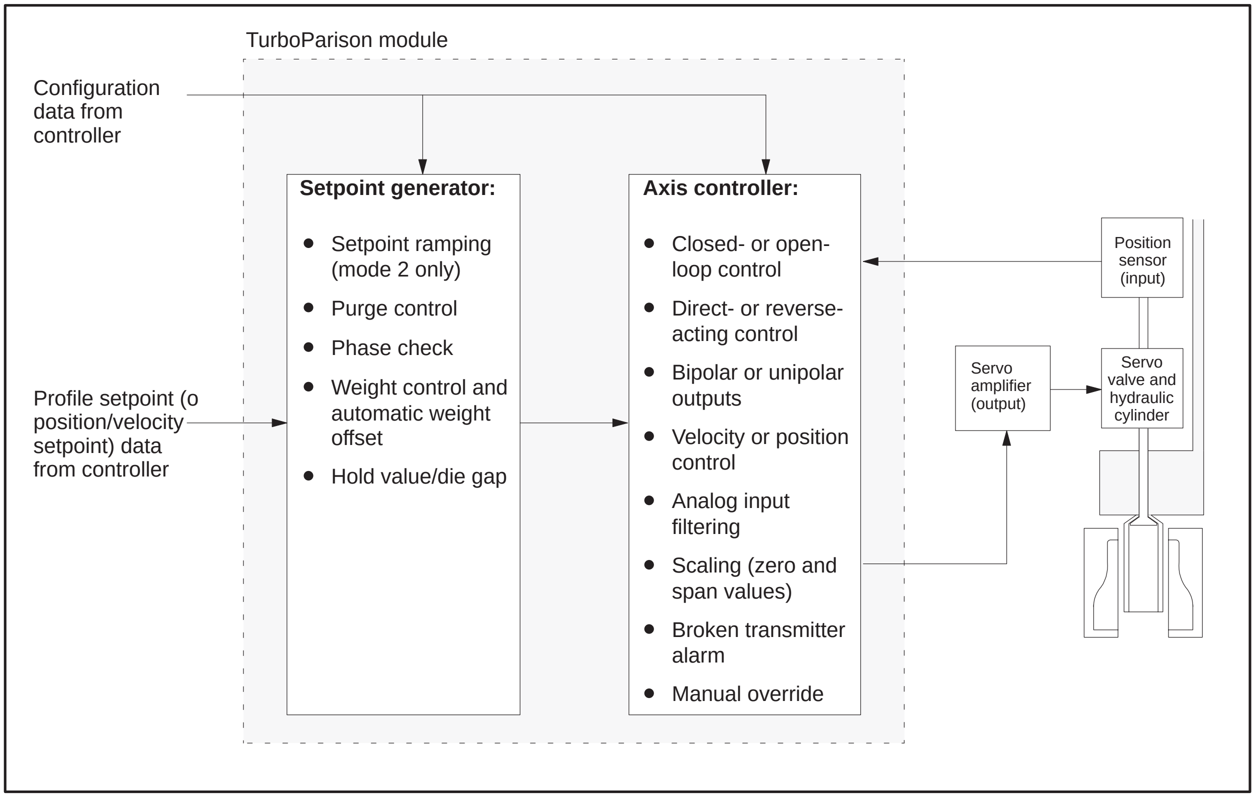


Figure 3-6 Configurable Elements within the Module

NOTE: The module is also capable of controlling the velocity of a ram. See Chapter 5 for more information.

Setpoint Generator

Figure 3-7 illustrates the operation of the setpoint generator section of the module. When the profile is enabled, the module reads the appropriate profile value from the Profile Setpoint Table, adds the weight settings, and sends the resulting setpoint to the axis controller. When the profile is not enabled, the hold value (typically the die gap setting) becomes the controller setpoint.

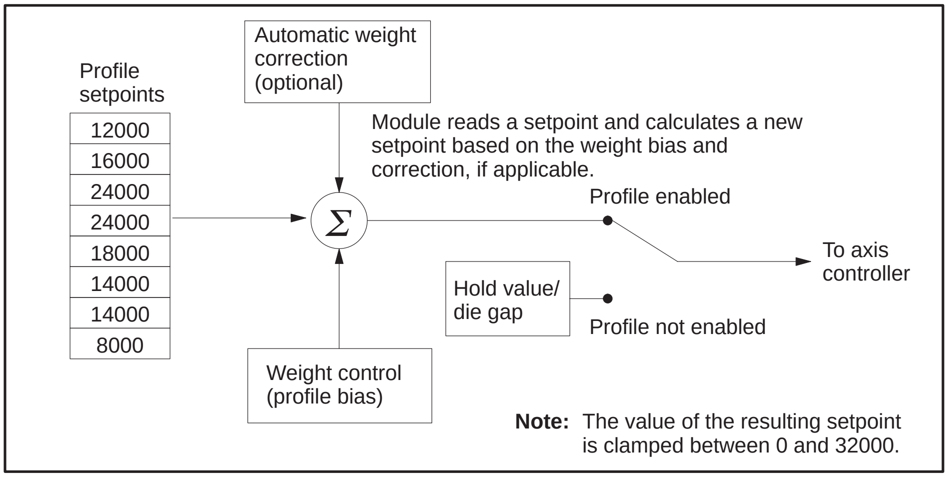


Figure 3-7 Setpoint Generator Operation

Table 3-1 describes each of the configurable elements in Figure 3-6 that define setpoint generator operation. These elements are selectable and can be added or removed depending on the needs of the process.

Table 3-1 Setpoint Generator Description

Element	Description
Setpoint ramping (mode 2 only)	Module ramps between setpoint entries, providing very smooth transitions between setpoints (available in mode 2 only).
Purge control	Allows you to specify the die gap during an accumulator or extruder purge. This value overrides the current profile setpoint.
Phase check	Allows you to mark a parison while running a profile. You specify the number of steps for which the die opens to the phase check value. This value overrides the current profile setpoint.
Weight control	Allows you to control the weight of a parison. This element determines the absolute weight bias for a parison.
Automatic weight correction	Allows you to manipulate the profile of a parison without changing the overall weight. For more information about automatic weight control, see Section 7.2.
Hold value/die gap	For die heads: specifies the die gap setting when profiling is disabled. For accumulator ram: specifies the hold value to the axis controller when not running the velocity profile.

Axis Controller

Figure 3-8 illustrates the operation of the axis controller section of the module. Each axis consists of an axis controller that provides feedback control to a die head or ram, depending on the operational mode of the module. The elements depicted in this diagram affect the operation of the module and are configurable. For example, the closed-loop/open-loop element allows you to choose the type of loop the module uses to control a die head or ram.

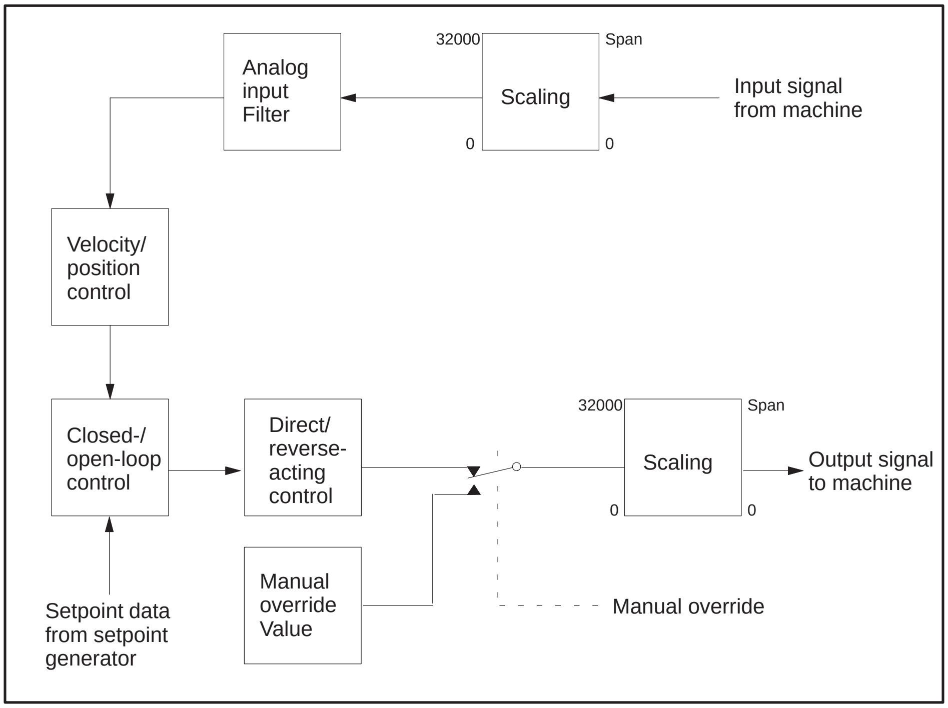


Figure 3-8 Axis Controller Operation

Table 3-2 describes each of the configurable elements in Figure 3-8 that define axis controller operation. These elements are configurable and can be added or removed by manipulating the configuration word for each axis. See Appendix B for more information on the configuration word.

Manual Override

Each control axis (ouput) has a manual override control bit and value associated with it. This allows the analog output to be forced to a manual override value whenever the corresponding control bit is set to one. The conrol bits are 9, 10, 11, and 12 in WY7. The manual override values for each axis are located in the continuous download portion of the configuration table in V-memory (see Appendix B). These values are automatically downloaded to the module (usually once every controller scan). When one or more of bits 9 – 12 of WY7 are set, the manual override for the corresponding axis is/are enabled. This causes the associated output to be forced to the manual override value. When the bit returns to zero, normal axis operation resumes, and, if the axis is configured for closed loop operation, it causes a bumpless transfer.

Table 3-2 Axis Controller Description

Element	Description
Closed-loop or open-loop control	Provides closed-loop control for the die head or accumulator ram. Closed-loop control allows the module to manipulate the output in order to maintain the position or velocity specified by the setpoint. You can bypass this feature and provide open-loop control (setpoint drives output directly). Mandrel position (wall thickness control) is usually controlled in closed-loop. Ram velocity may be controlled in either open- or closed- loop. (Bit 14 in configuration word.)
Direct- or reverse-acting control	Provides selection for direct- or reverse-acting processes. This feature is typically used to select either converging or diverging tooling. See Section 6.4 for more information about converging/diverging tooling. (Bit 15 in configuration word.)
Bipolar or unipolar loop selection	Selects either bipolar or unipolar loop operation. When bipolar is selected the loop controller output is in the range –32000 to +32000. When unipolar is selected the loop controller output is in the range 0 to 32000. Bipolar loop outputs are typically used for controlling servo-amps (such as used in die position control). (Bit 10 in configuration word.)
Velocity or position control	Provides differentiation to convert position readings into velocity data. (Bit 13 in configuration word.)
Analog input filtering	Provides first order exponential filtering for input data. Filtering helps reduce the adverse effects of noise on the input. If you do not select this feature, the module does not filter the incoming data. (Bit 16 in configuration word.)
Scaling (zero to span value)	Provides scaling of input and output values. The scaling element scales the 0 to 32000 range (used by the module) to the zero to span voltage (used by the machine).
Broken transmitter alarm	Provides a method for signaling an alarm condition for a broken transmitter. (Bit 11 in configuration word.)
Manual override	Provides a method to control an axis output independent of the operation of the axis controller (Bits 9, 10, 11, and 12 in WY7).

For more information on configuring axes, refer to Appendix B. Note in particular the description of the configuration word.

3.4 Downloading and Uploading Tables

Downloading Configuration and Setpoint Tables

Ensure that you have entered the required configuration information in the controller's V-memory before you download the Configuration Table to the module. You can download the Configuration Table to the module two ways:

- You can place the module in RUN or CALIBRATE mode; the module then automatically downloads the Configuration Table and related Setpoint Tables.
- While the module is in RUN or CALIBRATE mode, you can force a download by setting bits in WY7 to 1. Bit 1 automatically downloads the Configuration Table. Bits 2-5 download Setpoint Tables. When the download is complete, the module sets corresponding bits (1– configuration, 2 – 5 setpoint) in WX4. The acknowledge bits in WX4 are not cleared until the corresponding command bit in WY7 returns to 0. See Figure 3-9.

NOTE: The TurboParison module does not automatically enter the RUN mode when you power it up. This characteristic enables you to determine the V-memory addresses of the Configuration Table, the General Status Table, and related tables before the module attempts to control a machine.

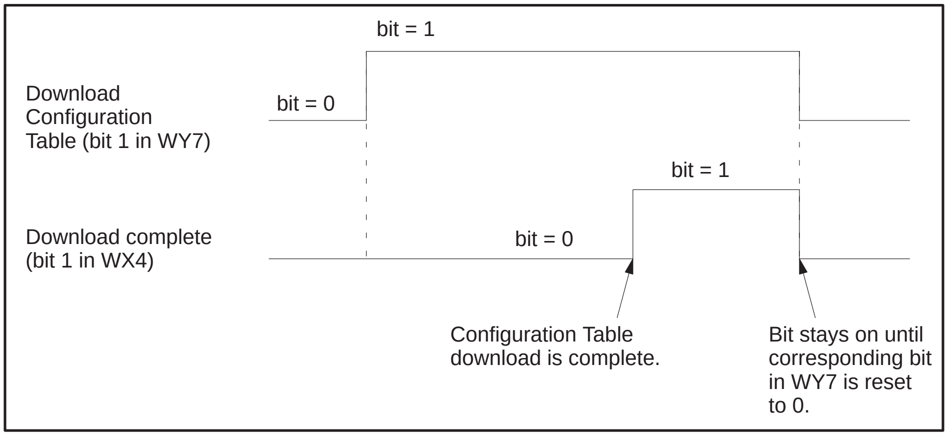


Figure 3-9 Timing for a Forced Table Download

Uploading General Status and Process Variable Tables

The General Status Table is uploaded to the controller, typically, once every controller scan. Certain operations such as interpolation or the download of other tables may delay this upload.

Process Variable Tables are uploaded to the controller either upon completion of profile execution or when a synchronization pulse is received, signifying the start of a new parison. The module notifies the controller that an upload of PV Table 1, 2, 3, or 4 is in progress by setting Bits 9, 10, 11, or 12 respectively, in WX4 to 1. The corresponding bit remains set for at least 1 controller scan. When the bit returns to 0, the upload is complete.

3.5 Guidelines for Allocating V-Memory

The module reads data from several tables that are located in various areas of V-memory. Other operations, such as interpolation and table expansion, also require blocks of V-memory. You need to map V-memory carefully to be sure that the memory allocation does not cause tables to overlap. Lay out your memory map according to these guidelines. Although each table must consist of contiguous memory locations, the individual tables do not have to be contiguous.

- The Configuration and General Status Tables require 300 contiguous memory locations.
- The size of the Profile Setpoint Table depends upon the number of setpoints that an axis requires. Be sure to allocate a table for each configured axis (see Chapters 4 and 5). Consider allocating enough memory to allow for table expansion.
- The size of the profile Process Variable Table is the same as the size of the Profile Setpoint Table for an axis (see Chapters 4 and 5). Be sure that you allocate a table for each axis that you configure.
- The size of the Velocity Setpoint Table (position-based configurations only) depends upon the number of different velocities needed to control a ram (see Chapter 5). Consider allocating enough memory to allow for table expansion.
- The size of the Position Setpoint Table (position-based configurations only) depends upon the number of different positions needed to control a ram (see Chapter 5). Consider allocating enough memory to allow for table expansion.
- If you intend to use the interpolation or table expansion features, allow enough V-memory for the master table and the calculated table (see Chapter 7). You may want to allocate memory for these features for each configured axis.

The worksheets in Appendix E can help you lay out the memory maps.

3.6 Guidelines for Errors and Alarms

Fatal Errors

If a fatal error is detected, the module drives all analog outputs to zero volts and turns off all discrete outputs. If possible, the module turns off the RUN or CALIBRATE mode bit in WX4, and sets the Fatal Error bit in WX3 (Bit 4) to one. All communication activity with the controller halts. The MOD GOOD and RUN LEDs then flash in an alternating pattern, indicating that a fatal error has been detected. A power-up reset can restore operation, provided that the error does not persist.

Some causes of fatal errors follow.

- The module loses communication with controller (e.g., the module is installed in a remote base and the I/O cable is disconnected).
- The watch-dog time-out occurs (this could be caused by spurious electrical noise or component failure).

Alarms

The module provides a broken transmitter alarm for each control axis. Each broken transmitter alarm is enabled by setting Bit 11 in the configuration word for that axis (see Appendix B). If enabled, the module checks the analog input for zero volts. If a zero volts is detected, the corresponding alarm bit in the General Status Table is set. See Appendix C.

To clear the alarm, reset the alarm enable bit to zero. To use this feature, ensure that your input range does not include zero volts.

Chapter 4
Time-based Operation

4.1 Overview

The TurboParison module provides control of time-based equipment, e.g., wheel machines, shuttle machines, and other types of continuous extrusion machines. This chapter describes time-based operation and shows how to configure the module for this mode of operation.

Definition of Time-based Operation

In the time-based mode, the module uses a synchronization pulse to start a new parison. Because a time-based machine extrudes continuously, the length of time between the synchronization pulses determines the length of the parison. This pulse also determines the length of time between profile steps (zones).

A user-provided synchronization pulse starts a new parison by causing the module to reset to the first profile setpoint. The module then processes all setpoints and holds at the last setpoint until a new synchronization pulse is received.

The total profile time (P_t) is the time it takes for the module to execute a profile. Determine the initial value for P_t by entering a value in the Initial Profile Time field of the Configuration Table.

The module then enables you to either set a fixed profile time or select a variable profile time. To specify whether the initial profile time is used continually or is changed by a math calculation, enter one of the codes from Table 4-1 in the Profile Time Calculation Method field of the Configuration Table.

Table 4-1 Methods for Calculating Profile Time

Code	Calculation Method
0	Use value in Initial Profile Time field for P_t.
1	Use time between last two synchronization pulses (previous P_t.)
2	Use a running average determined by the following equation: $$P_t = (P_t + P_t \textit{ previous}) / 2$$
3	Use the mean of the last *n* profile times. You specify *n* in the **#** of Cycles to Average Profile Time field of the Configuration Table.

The time that the module holds at each setpoint (S_t) is determined by dividing P_t by the number of setpoints (N). The relationship between the profile setpoints and the synchronization pulse is shown in Figure 4-1.

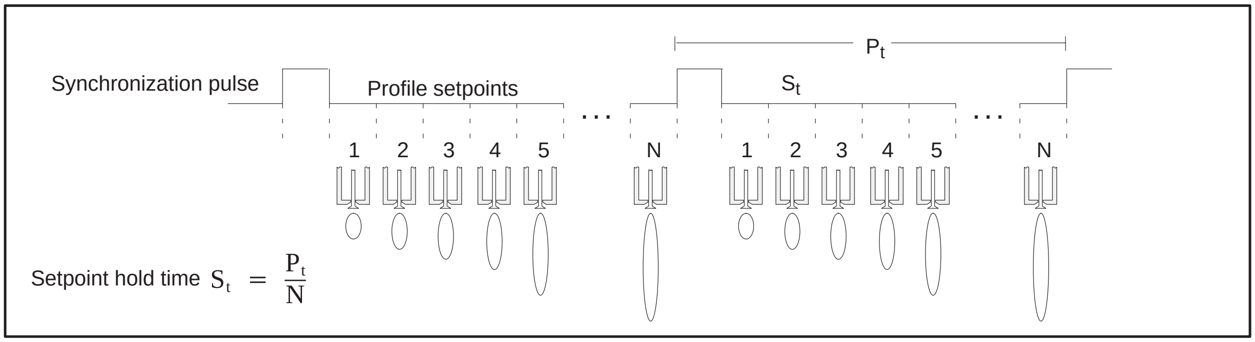


Figure 4-1 Relationship of Synchronization Pulse to Profile Setpoints

Because sync pulses determine the start of a new parison drop, any variation in the time between the pulses can affect how the module handles a profile. If the time between two sync pulses is greater than the current P_t, the die remains at the position determined by the last profile setpoint until the next pulse occurs. If a sync pulse occurs in the middle of a profile, that profile stops execution, and a new one begins. Figure 4-2 shows the machine sequence for a fixed profile time.

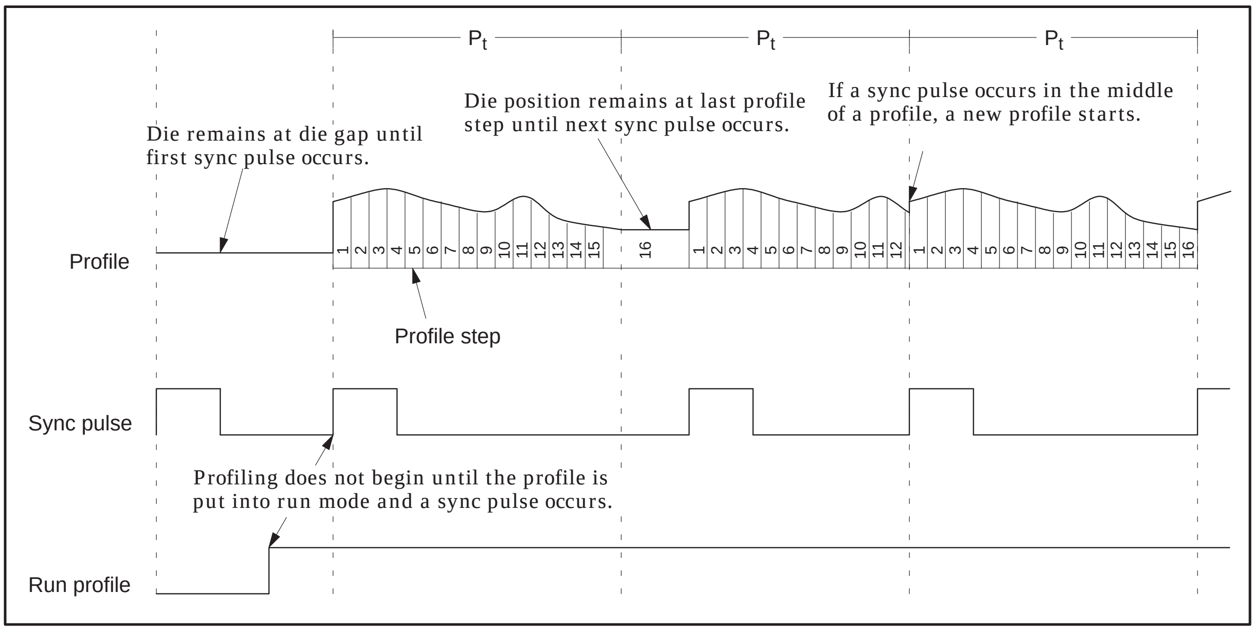


Figure 4-2 Machine Sequence Timing Example

Controlling Mandrel Position (Wall Thickness)

The module uses profile data stored in a table to control the mandrel position that determines the wall thickness of a parison. This table, called the Profile Setpoint (SP) Table (Figure 4-3), is downloaded from the controller to the module either when you put the module in RUN mode, or by your command.

Create a Profile Setpoint Table for each die. Specify the starting address for the table by entering an address into the Profile SP Starting Address field in the Configuration Table. Tables do not have to be contiguous. To specify the length of each Profile Setpoint Table, enter a value (choices are: 2, 4, 8, 16, 32, 64, 128, or 256) in the Profile SP Table Length field in the Configuration Table.

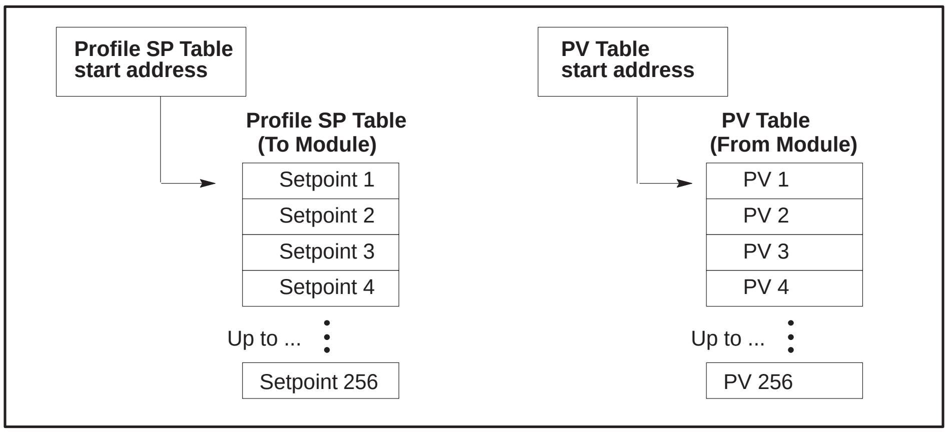


Figure 4-3 Profile SP and PV Tables

Monitoring Mandrel Position

The module enables you to compare the actual mandrel position to the profile data. To monitor the actual position, you must set up a table in V-memory into which the module writes the actual position (process variable) attained at the end of each profile step. This table is called the Process Variable (PV) Table.

Specify the starting address for the PV Table by entering an address into the PV Table Starting Address field in the Configuration Table. Tables for the various profiles do not have to be contiguous (Figure 4-3). During operation, the entire table of process variables is uploaded to the controller automatically at the completion of a profile. If zero is entered into the PV Table Starting Address field, no table is uploaded for the corresponding profile.

The table length is automatically set to the same as that of the Profile Setpoint Table. When you assign table addresses for the various data tables, be sure to allocate V-memory carefully so that no data can be overwritten.

Providing a Sync Pulse for Profile Timing

The TurboParison module has four 24 VDC discrete inputs. These inputs receive hardware-generated sync pulses for running time-based machines. These pulses can be supplied by a programmable limit switch or other device. The pulse must be greater than one millisecond in duration, and the time between pulses must be greater than one millisecond, as is shown in Figure 4-4.

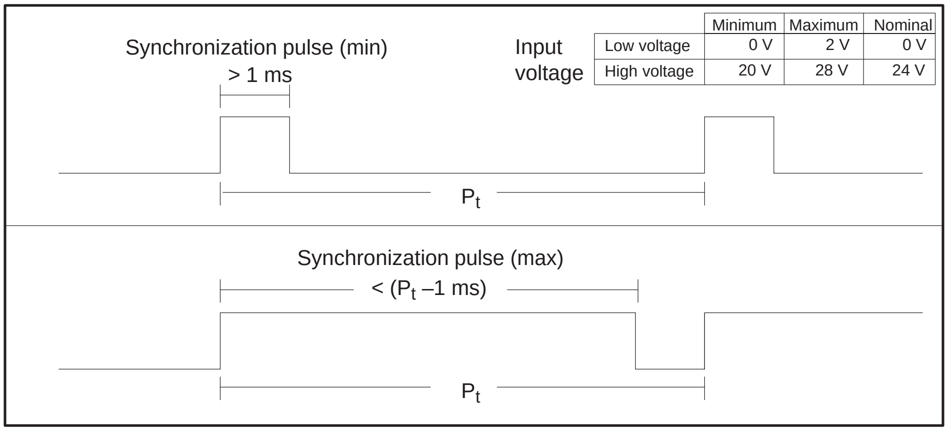


Figure 4-4 Relationship of Synchronization Pulse to Profile Time

Alternatively, you may choose to generate the sync pulse in your RLL program by toggling bits 13, 14, 15, and 16 in WY8. These bits correspond to Profiles A through D, respectively. Refer to Appendix A for a description of the bit locations in WY8.

For a software-generated sync pulse to work, the pulse length must be greater than one controller scan.

NOTE: For high-speed operation, you must input the synchronization pulse through the module's discrete I/O points because the controller scan time is usually not fast enough to allow the RLL to generate a sync pulse.

4.2 Characteristics of High-Speed and Standard-Speed Operation

The module can operate in either a high-speed or a standard-speed mode depending on the length of the total profile time required by your process. This section describes the two modes and their differences.

High-Speed Operation (Mode 1)

When configured for high-speed operation, the TurboParison module has the following characteristics.

- Axes 1 and 2 are available for profile control.
- Axes 3 and 4 are not available for profile control, but can be configured for either closed-loop operation or open-loop operation. Open-loop operation enables you to configure these axes as analog I/O.
- A minimum sample rate of one millisecond is available.
- Each axis can have a unique profile and weight constant or axes can share profiles.
- A minimum profile time of 512 milliseconds is available for up to 256 profile steps.
- The use of a hardware-generated sync pulse is recommended.

Figure 4-5 shows a typical application of high-speed mode.

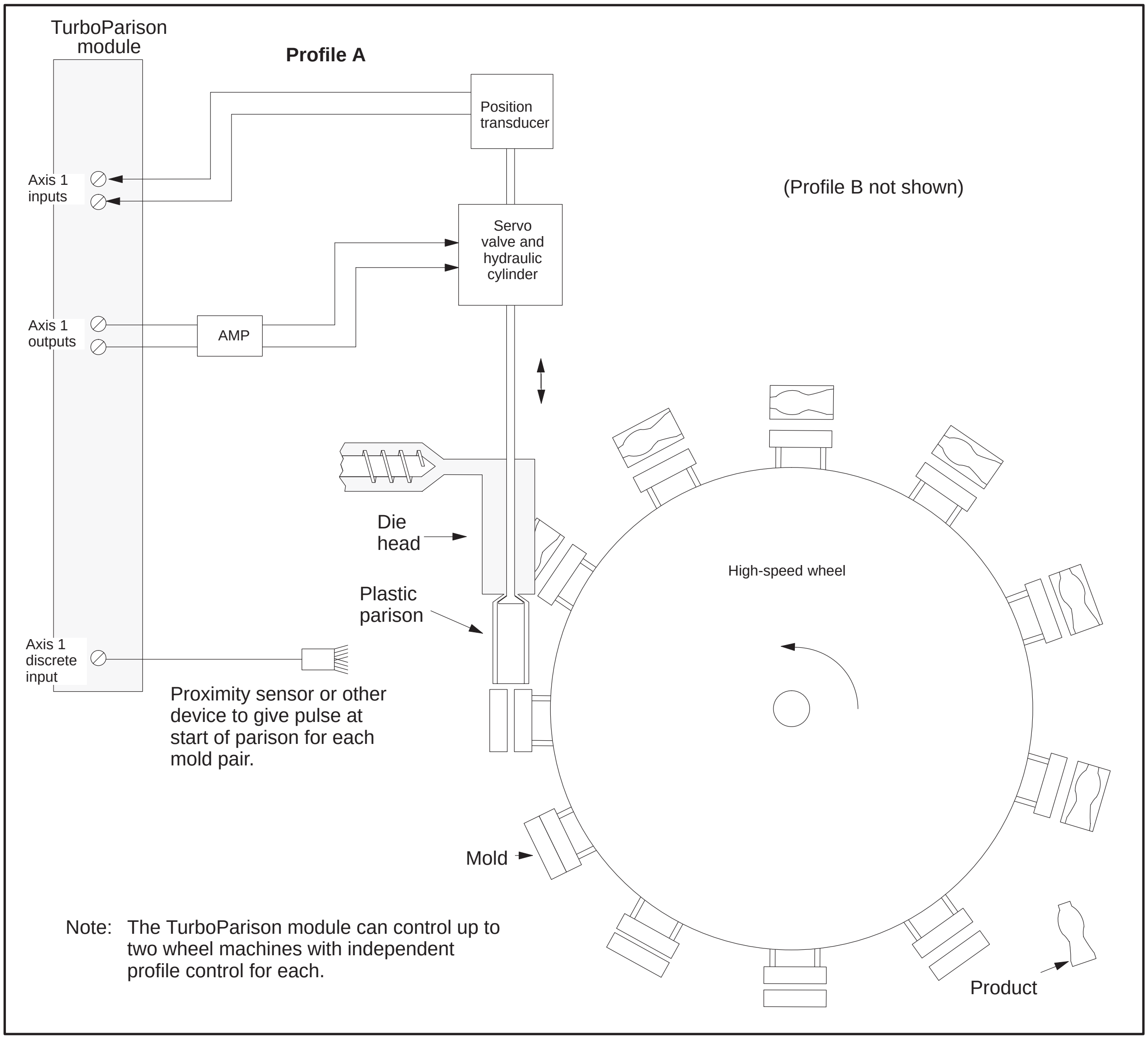


Figure 4-5 Example of High-Speed Operation

Standard-Speed Operation (Mode 2)

When configured for standard-speed operation, the TurboParison module has the following characteristics.

- Four independent axes are available for profile control.
- Each axis can have a unique profile and weight constant or axes can share profiles.
- A minimum sample rate of one millisecond is available.
- A minimum profile time of one second is available for up to 256 profile steps. This time is adequate for most time-based applications.
- Either a hardware-generated sync pulse or a software trigger (in RLL) is used to start a new parison drop.

Figure 4-6 shows a typical application of standard mode. This mode is adequate for most time-based applications.

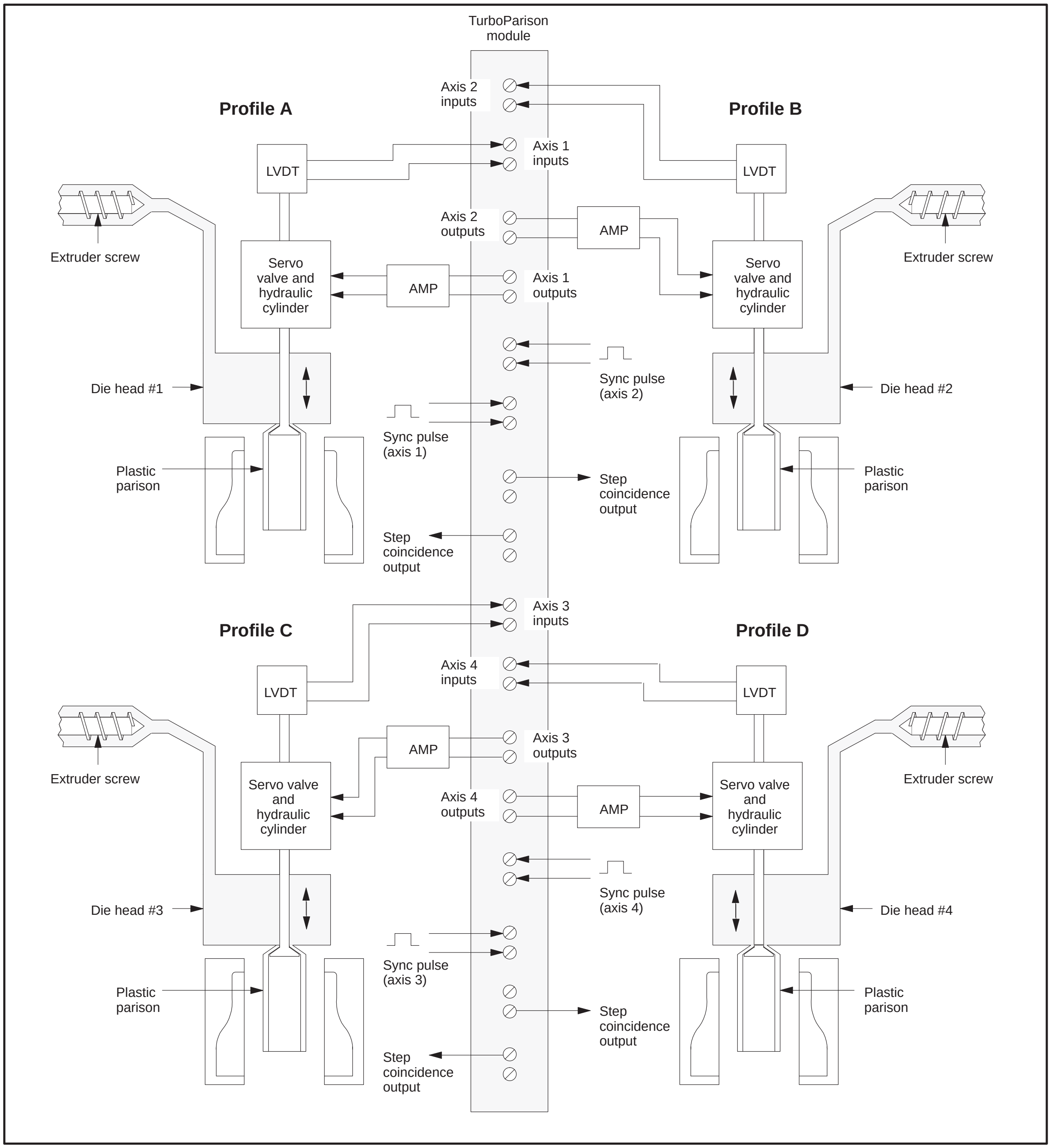


Figure 4-6 Example of Standard-Speed Operation

Characteristics of High-Speed and Standard-Speed Operation (continued)

Differences in High-Speed and Standard-Speed Operation

The high-speed and standard-speed modes operate essentially in the same way, except for a few important differences. In high-speed mode, the module controls up to two die heads; in standard-speed mode, the module controls up to four die heads. In addition, the speed capability and the profile times differ for the two modes. These differences occur because of the resolution and maximum values of the timers.

When the module is configured for two high-speed profiles, a dedicated hardware timer with a 12.8 microsecond period is used to time the transitions between profile steps. In standard-speed mode, the module uses a one millisecond timer. Because the transition time between profile steps is determined by both the number of steps and the total profile time, the minimum and maximum profile times depend on the number of steps used. Table 4-2 shows time values for the number of profile steps.

Table 4-2 Profile Time vs. Number of Profile Steps

Profile steps	High-Speed Mode		Standard-Speed Mode	
	Minimum	Maximum	Minimum	Maximum
2	4 ms	750 ms	8 ms	65 seconds
4	8 ms	1.5 seconds	16 ms	65 seconds
8	16 ms	3 seconds	32 ms	65 seconds
16	32 ms	6 seconds	64 ms	65 seconds
32	64 ms	13 seconds	128 ms	65 seconds
64	128 ms	26 seconds	256 ms	65 seconds
128	256 ms	53 seconds	512 ms	65 seconds
256	512 ms	65 seconds	1024 ms	65 seconds

When the module is in high-speed mode, only two axes (numbers one and two) are available for profile control. The two remaining axes are still operational, but they cannot be configured for closed-loop control. If you want to use these axes to control a die, you must program the controller so that it generates the profile setpoints.

4.3 Determining Module Configuration Parameters

As discussed in Chapter 3, the Configuration Table contains process parameters that determine the operation of the TurboParison module. The module uses these parameters to calculate loop variables, offsets, and other numeric values that are essential to parison control.

To determine which process parameters are available for use with the TurboParison module when operating it in time-based mode, refer to Table 4-3. Remember that dies C and D are available for die control only in mode 2. The **bold** parameters are essential for proper operation.

Table 4-3 Configuration Table for Time-based Operation

V-memory offsets (WY5 + *offset*)				Parameter name	Valid values
Head A	Head B	Head C*	Head D*		
0	40	80	120	**Configuration word**	See description
1	41	81	121	T_s — loop sample time	1 to 32,767 milliseconds
2	42	82	122	Calibration zero for analog input	0 to 10,000 mV
3	43	83	123	Calibration span for analog input	0 to 10,000 mV
4	44	84	124	T_f — input filter time constant	0 to 32,767 milliseconds
5	45	85	125	Reserved	0
6	46	86	126	$P_{t\ initial}$ — Initial profile time	0 to 65,535 milliseconds
7	47	87	127	**K_c — proportional gain constant**	0 to 327.67
8	48	88	128	**T_i — integral time constant**	0 to 32,767 milliseconds
9	49	89	129	T_d — derivative time constant	0 to 327.67 milliseconds
10	50	90	130	Output zero	–10,000 to +10,000 mV
11	51	91	131	Output span	–10,000 to +10,000 mV
12	52	92		**Profile Setpoint Table starting address**	0 to 65,000
13	53	93	133	**Profile Setpoint Table length**	2, 4, 8, 16, 32, 64, 128, 256
14	54	94	134	Process Variable Table starting address	0 to 65,000
15	55	95	135	Sync delay (phase shift) time	0 to 65,535 milliseconds
16	56	96	136	Purge value	0 to 32,000
17	57	97	137	Weight control	–32,000 to +32,000
18	58	98	138	Phase check location	0 to 255
19	59	99	139	Phase check setpoint	0 to 32,000
20	60	100	140	Number of steps to hold phase check	0 to 256
21	61	101	141	Profile time calculation method	0, 1, 2, 3
22	62	102	142	Number of cycles needed to average profile time	2, 4, 8, 16
23	63	103	143	Profile time-out value	0 to 65,535 milliseconds
24	64	104	144	Profile step coincidence location	0 to 255
25	65	105	145	Number of steps to hold profile coincidence output	0 to 256
26–39	66–79	106–119	146–159	Reserved	0

* Profile execution available only for mode 2.

Table 4-3 Configuration Table for Time-based Operation (continued)

V-memory offsets (WY5 + *offset*)	Parameter name	Valid values
160	Calibration zero for analog input 5	0 to 10,000 mV
161	Calibration span for analog input 5	0 to 10,000 mV
162–169	Reserved	0
170	Interpolation master table starting address	0 to 65,000
171	Interpolation calculated table starting address	0 to 65,000
172	Interpolation table length	2, 4, 8, 16, 32, 64, 128, 256
173	Interpolation method	0: linear interpolation 1: curvilinear interpolation
174	Starting address of original table	0 to 65,000
175	Length of original table	2, 4, 8, 16, 32, 64, 128, 256
176	Starting address of expanded table	0 to 65,000
177	Length of expanded table	2, 4, 8, 16, 32, 64, 128, 256
178–179	Reserved	0
180	Head A die gap (continually downloaded)	0 to 32,000
181	Head B die gap (continually downloaded)	0 to 32,000
182	Head C die gap (continually downloaded)	0 to 32,000
183	Head D die gap (continually downloaded)	0 to 32,000
184	Axis 1 manual override value (continually down-loaded)	–32000 to +320000
185	Axis 2 manual override value (continually down-loaded)	–32000 to +32000
186	Axis 3 manual override value (continually down-loaded)	–32000 to +32000
187	Axis 4 manual override value (continually down-loaded)	–32000 to +32000
188–199	Reserved	0

If a parameter value is zero, the module uses the default value. For detailed descriptions of the parameters and their default values, refer to Appendix A.

Determining Configuration Parameters

After you determine which parameters are required for your machine, turn to Appendix E and make a copy of the worksheets that correspond to the time-based mode. These worksheets enable you to record parameters and values that you intend to enter into the Configuration Table.

Determining the V-Memory Required

Before you enter the worksheet information into V-memory, you must determine the amount of memory to set aside. To determine the amount of required V-memory, refer to the worksheets you filled out and use the data from those worksheets to fill out the V-memory Allocation Worksheet found in Appendix E. For example, if WY5 is V100 and you want to enter the starting address of the Profile Setpoint Table for die head C (mode 2), enter data in V-memory location 192 (WY5 + 92).

Entering Data into V-Memory

After you set aside the appropriate amount of V-memory, you are ready to enter the values from the worksheets into memory. To enter the configuration values from an operator interface, read your user manual for the operator interface. To enter the configuration values from TISOFT, follow these steps.

1. Run TISOFT and display the screen that allows you to edit V-memory.
2. Enter the values from the Configuration Table Worksheet into the V-memory locations listed on the worksheet.
3. If you do not have an operator interface, enter values for the Profile Setpoint Table now.

NOTE: If you change any values in the Configuration Table or Profile Setpoint Table while a profile is running, you must instruct the module to download the tables again before the changes can affect the operation of the module.

4.4 Preparing the Module for Operation

Before you operate the TurboParison module, complete and check off the following sets of tasks.

✓ Set the dipswitches for the correct operational mode, set the voltage jumpers to match the voltage for your I/O devices, install the module in the base, and make the appropriate field connections to the front of the module. See Chapter 2.

✓ Run TISOFT and configure the controller I/O for the TurboParison module's location and type. After you log the module into the controller, determine the controller V-memory allocation requirements for your configuration. See Section 4.3.

✓ Determine the machine sequence for your process, and then write an RLL program to sequence the machine and interact with the module.

✓ Load the Configuration Table with the parameter values that correspond to the axis or axes. Appendix B lists and describes all of the available parameters.

✓ Ensure that all data relevant to your parison process exists in the V-memory locations reserved for the Configuration Table and Profile Setpoint Table. These tables are automatically downloaded to the module when you place the module in RUN mode. See Section 4.5.

✓ Provide an external or internal sync pulse. For an external sync pulse, ensure that the signal or signals are attached to the appropriate input on the module and that Bits 13 through 16 in WY8 are set to zero. For an internal sync pulse, ensure that your RLL program toggles the bits (13 through 16 in WY8) for the corresponding profile(s). The internal sync bit must remain high for at least one controller scan.

✓ Ensure that the die heads are calibrated and tuned. Refer to Chapter 6 for information about calibrating and tuning die heads.

✓ Manually step the machine through its sequence before you run the RLL and sequence the machine automatically.

4.5 Operating the Module in Time-based Mode

Putting the Module in RUN Mode

WY6 controls putting the module into RUN mode:

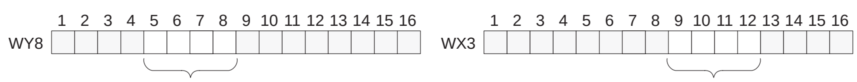
✓ Writing a value of 5000 hexadecimal (20480 decimal) in WY6 puts the module in RUN mode. All configuration information is automatically downloaded from the controller and the module enables all axis controllers. The module RUN light comes on and the RUN acknowledge bit (WX4 Bit 8) is set to one.

✓ Writing a zero to WY6 takes the module out of RUN mode. All analog outputs are forced to 0 V, all discrete outputs are turned off, the module RUN light turns off and the RUN acknowledge bit is reset to zero. This corresponds to an Emergency Stop (ESTOP) condition.

> **⚠ CAUTION**
>
> **Ensure that you do not require a controlled shutdown before you perform an ESTOP.**
>
> **If you do not initiate a controlled shutdown procedure before performing an ESTOP, you may cause equipment damage.**
>
> **It is to your advantage to shut down in a controlled manner before you perform an ESTOP.**

Enabling/Disabling Profile Execution

To start profile execution, set the corresponding profile enable bit in WY8 to 1. The module then sets a corresponding bit in WX3 to signify the profile is active. Profile execution begins at the start of the first sync pulse. The setpoint returns to the die gap/hold value when the profile is disabled.



Enables Profile	
Profile A	Bit 5
Profile B	Bit 6
Profile C	Bit 7
Profile D	Bit 8

Module Response	
Profile A	Bit 9
Profile B	Bit 10
Profile C	Bit 11
Profile D	Bit 12

See Appendix A for a complete description of WX/WY words and more information about profile operation.

4.6 Changing Configuration and Profile Data

To change data in the Configuration Table or the Profile Setpoint Table, access the V-memory locations to change data and enter the new data. If you have an operator interface, access the parameters and/or setpoints with the screen and enter the new data.

Before any changes can become effective, however, you must download the tables from the controller to the module. When you place the module in RUN mode, the tables are automatically downloaded to the module. If the module is already in RUN mode and you make changes to one or more of the tables, your RLL program must instruct the module to download one or more of the tables.

The procedure outlined in Figure 4-7 shows you how to download the tables when the module is in RUN mode.

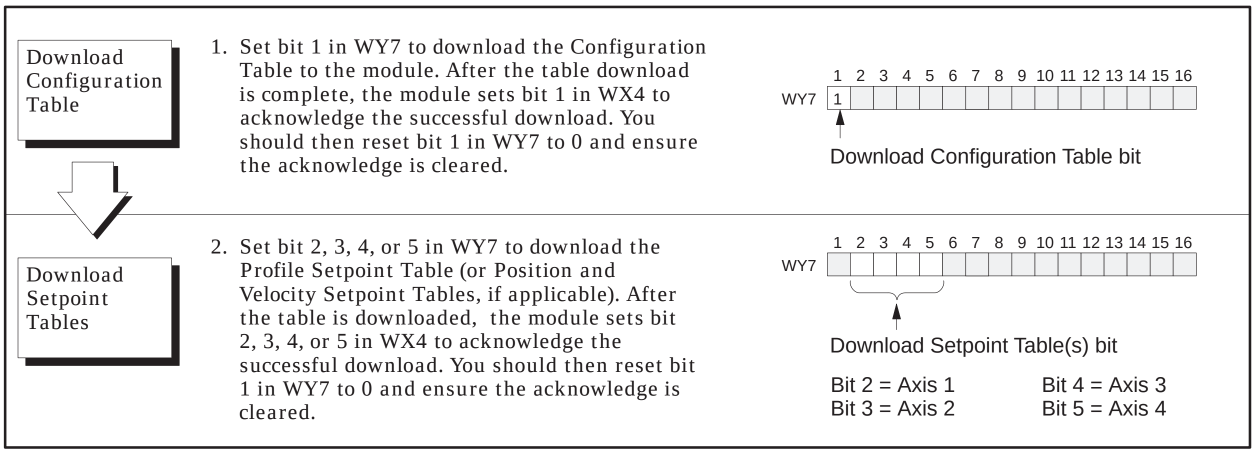


Figure 4-7 Downloading Tables in RUN Mode

4.7 Monitoring the Operation of the Module

The General Status Table enables you to monitor the operation of the module. This table consists of module-related data that is uploaded from the module to the controller. Like the Configuration Table, the parameters in the General Status Table are offset from the V-memory address specified by WY5. Table 4-4 shows the contents of the General Status Table.

Table 4-4 General Status Table Contents

V-memory offsets (WY5 + *offset*)	Parameter description
200	Current analog input from Head A (axis 1)
201	Current analog input from Head B (axis 2)
202	Current analog input from Head C (axis 3)
203	Current analog input from Head D (axis 4)
204	Current analog input from auxiliary input 5
205	Current PV from Head A (axis 1)
206	Current PV from Head B (axis 2)
207	Current PV from Head C (axis 3)
208	Current PV from Head D (axis 4)
209	Reserved
210	Current output for Head A (axis 1)
211	Current output for Head B (axis 2)
212	Current output for Head C (axis 3)
213	Current output for Head D (axis 4)
214	Current discrete inputs and outputs — Indicates the status of the discrete inputs and outputs. The word contained in this V-memory location has the following breakdown: MSB 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 LSB **Bits 1–4** Dipswitch settings: these bits may be used by the RLL to verify that the dipswitch was set correctly. 0000 Mode 1 0001 Mode 2 0010 Mode 3 0011 Mode 4 0100 Mode 5 **Bit 5–8** Not used. **Bits 9–12** Discrete output is on for the following: Bit 9 step coincidence for Profile A Bit 10 step coincidence for Profile B Bit 11 step coincidence for Profile C Bit 12 step coincidence for Profile D **Bit 13–16** Discrete input is on for the following: Bit 9 input for Profile A Bit 10 input for Profile B Bit 11 input for Profile C Bit 12 input for Profile D

Table 4-4 General Status Table Contents (continued)

V-memory offsets (WY5 + *offset*)	Parameter description
215	Broken transmitter alarm — Indicates whether a broken transmitter alarm is on for one or more of the axes. MSB … LSB: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 Bits 1 through 12 are not used. Bit 13 corresponds to die D (axis 4) Bit 14 corresponds to die C (axis 3) Bit 15 corresponds to die B (axis 2) Bit 16 corresponds to die A (axis 1)
216	Last profile time for die A (axis 1)
217	Last profile time for die B (axis 2)
218	Last profile time for die C (axis 3)
219	Last profile time for die D (axis 4)
220	$P_{t\ calculated}$ for die A (axis 1)
221	$P_{t\ calculated}$ for die B (axis 2)
222	$P_{t\ calculated}$ for die C (axis 3)
223	$P_{t\ calculated}$ for die D (axis 4)
224	Weight correction for profile A
225	Weight correction for profile B
226	Weight correction for profile C
227	Weight correction for profile D
228 – 299	Reserved

Chapter 5
Position-based Operation

5.1 Overview of Position-based Operation

The TurboParison module provides control of position-based equipment such as found on industrial blow-molding machines. This chapter describes position-based operation and shows you how to configure the module for this mode of operation.

Definition of Position-based Operation

In position-based mode, the module links profile execution to the position of the accumulator ram (or reciprocating screw). The total shot size is divided by the number of setpoint entries (N) for the profile. This results in N zones, where each zone has a corresponding setpoint in the Profile Setpoint table (Figure 5-1).

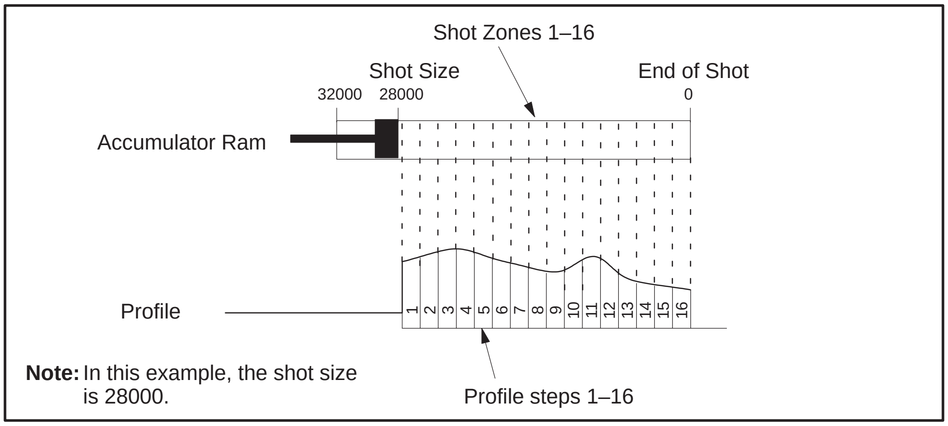


Figure 5-1 Relationship Between Ram Position and Profile

Figure 5-2 contains a machine timing diagram for a machine operating in position-based mode 3. In this example, the module provides open-loop velocity control for a ram. To control the die head, the module uses a profile consisting of eight steps. In this example, the following events occur.

- The controller commands the module to run profile A by setting Bit 5 in WY8.
- The module responds by setting Bit 9 in WX3. This response indicates that profile A is active.
- The module sets the voltage to the ram's proportional amplifier to a value corresponding to the first setpoint in the Velocity Setpoint Table.
- As the ram moves from shot size to zero, the module monitors the position of the ram and steps through the die head profile accordingly.
- When the ram reaches End-of-Shot (zero position), the profile running bit (Bit 9 in WX3) returns to 0 indicating profile execution is complete.

- When Bit 9 in WX3 returns to zero, the module forces the ram velocity amplifier voltage to zero until the profile run bit (Bit 5 in WY8) is reset to zero. At that time, the ram velocity goes to the back pressure setting (hold value).

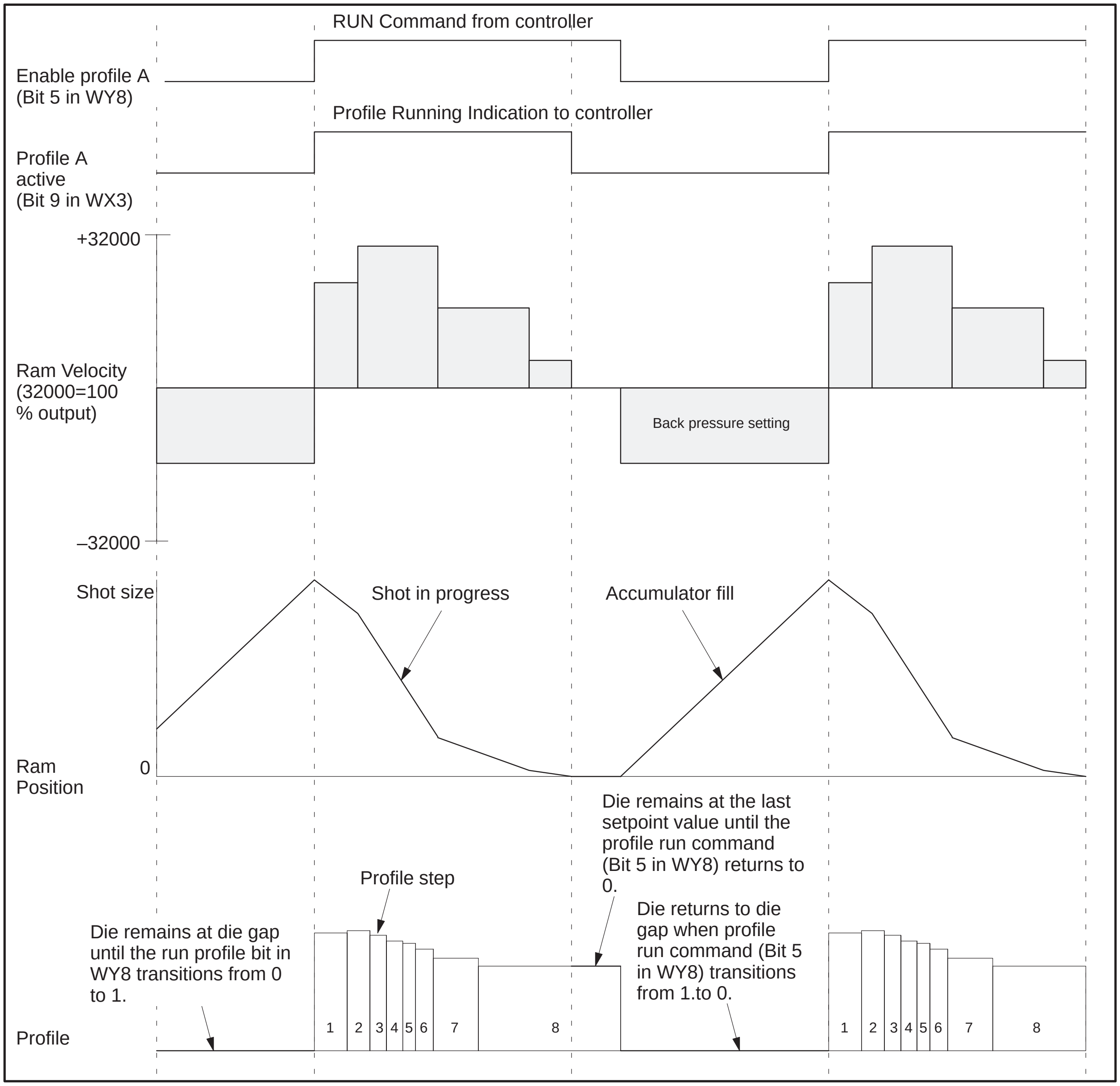


Figure 5-2 Machine Sequence Timing Example

Controlling Ram Velocity (Mode 3 Only)

Ram velocity can be handled through either open- or closed-loop control. In open-loop control, the module directly drives the output based on the velocity setpoint. In closed-loop control, the module attempts to match the velocity of the ram to a velocity setpoint. In either case, you can specify a velocity profile for ram push-out during profile execution.

Figure 5-3 shows a typical velocity profile (shot size equal to 28000) where transitions between velocity settings are specified by ram position. The TurboParison module allows you to specify up to a 256-step velocity profile; however, most applications require no more than 8 or 16 steps.

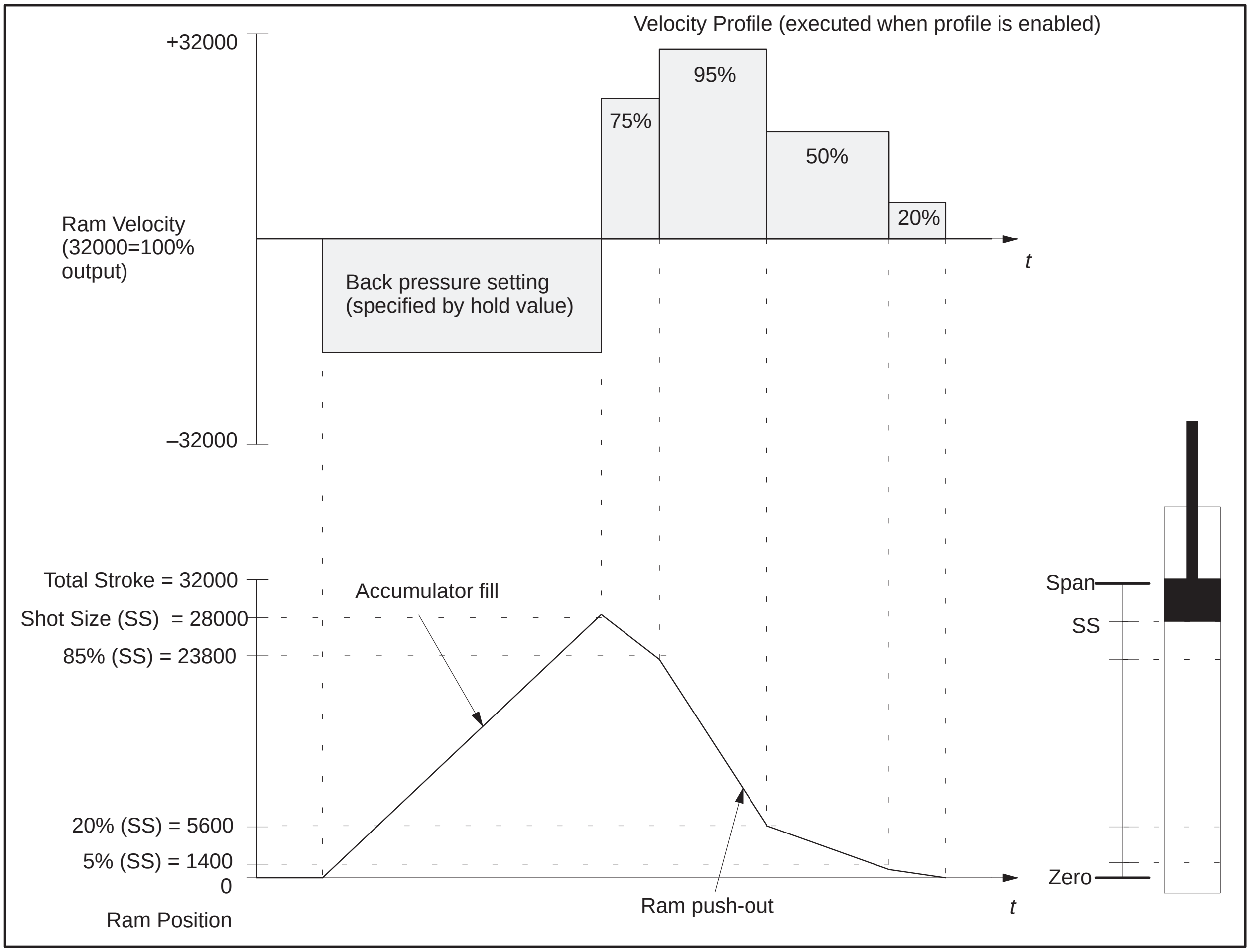


Figure 5-3 Example of the Relationship Between Ram Velocity and Position

NOTE: The velocity profile is executed during the ram push-out cycle, which begins upon transition to profile enable. When profile execution is disabled, the module forces the setpoint of the ram axis controller to the value specified in the hold location of the Configuration Table.

Figure 5-4 illustrates how the velocity profile shown in Figure 5-3 might be specified. The velocity setpoint information is entered into the Velocity Setpoint Table, and the position transition data is entered into the Position Table. These tables are located in the controller's V-memory. The module uses each velocity value in the table, which is a percentage of the maximum ram velocity, as a setpoint for the axis controller for the ram. Each velocity setpoint is used until the corresponding position location in the Position Table is reached.

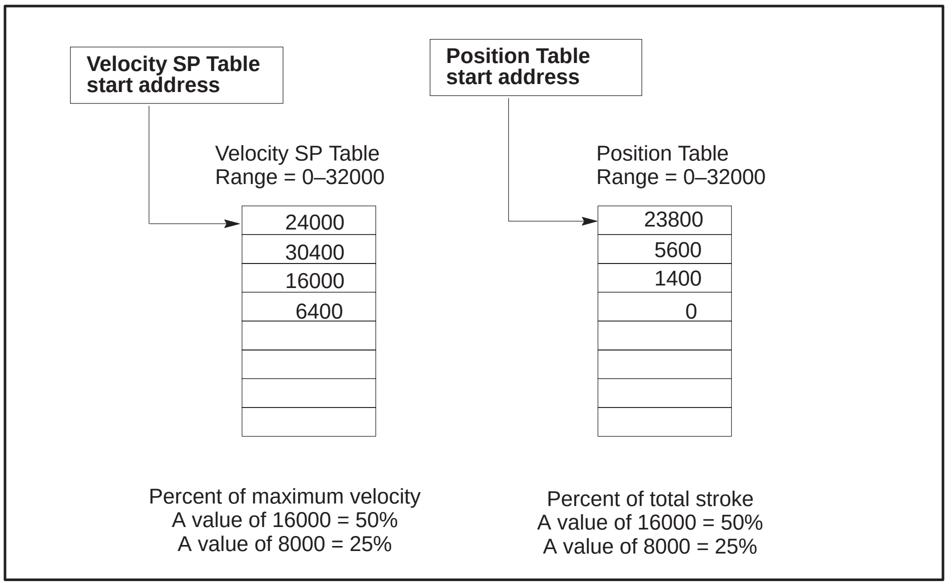


Figure 5-4 Specifying a Ram Velocity Profile

The values in the Velocity Setpoint Table can range from 0–32000. Therefore, 16000 = 50% of maximum velocity. Create a Velocity SP Table for each ram (one or two) that you want to control. Specify the starting address for a Velocity SP Table by entering an address into the **velocity SP starting address** field for axis 3 or 4 in the Configuration Table. Specify table length for a Velocity SP Table by entering a value (2, 4, 8, 16, 32, 64, 128, 256) into the **Velocity SP Table length** field in the Configuration Table.

The values in the ram Position Table can range from 0–32000. Therefore, 16000 = 50% of total stroke. Create a ram Position Table for each ram (one or two) that you want to control. You specify the starting address for a Position Table by entering an address into the **Position Table starting address** field for axis 3 or 4 in the Configuration Table. The length of the ram Position Table is the same as the Velocity SP Table.

The Velocity Setpoint Table and the Position Table are downloaded to the module automatically upon transition to RUN mode or by user command.

Open-Loop vs. Closed-Loop Velocity Control

In open-loop control, the velocity setpoint directly drives the module output. A loop tuning procedure is not required, thus making setup less difficult. You may specify the output span for the axis by entering this data into the Configuration Table. This determines the maximum output voltage to be sent to the valve amplifier.

In closed-loop control, the module attempts to match the velocity of the ram to the velocity setpoint. The module calculates the velocity of the ram based on the derivative of the ram position and the velocity scale factor that you provide. The velocity scale factor establishes the maximum ram speed which is designated as a setpoint value of 32000. The velocity scale factor may be interpreted as the number of counts (0 – 32000) that the ram can move in one second, where the full stroke is equivalent to 32000 counts. Enter this value in the **velocity scale factor** field for axis 3 or 4 in the Configuration Table. Alternatively, you may use the automatic maximum velocity calibration feature (see Section 6.4).

Guidelines for closed-loop control:

- Select closed-loop control by setting Bit 14 in the configuration word for that axis. (You may need to use open-loop control for accumulator fill; the RLL may need to switch between open- and closed-loop control)
- Select the differentiate process variable feature by setting Bit 13 in the configuration word for that axis.
- Ensure that the loop sample time, Ts, allows enough ram movement so that differences in position can be monitored (20 ms – 40 ms may be adequate).

Controlling Mandrel Position (Wall Thickness)

The module uses profile data stored in the Profile Setpoint Table to control the mandrel position that determines the wall thickness of a parison. This table (Figure 5-5), is downloaded from the controller to the module when you put the module in RUN mode.

Create a Profile Setpoint (SP) Table for each die and specify the starting address for the table by entering an address into the **profile SP starting address** field in the Configuration Table. To specify the length of each Profile Setpoint Table, enter a value (choices are: 2, 4, 8, 16, 32, 64, 128, or 256) in the **Profile SP Table length** field in the Configuration Table.

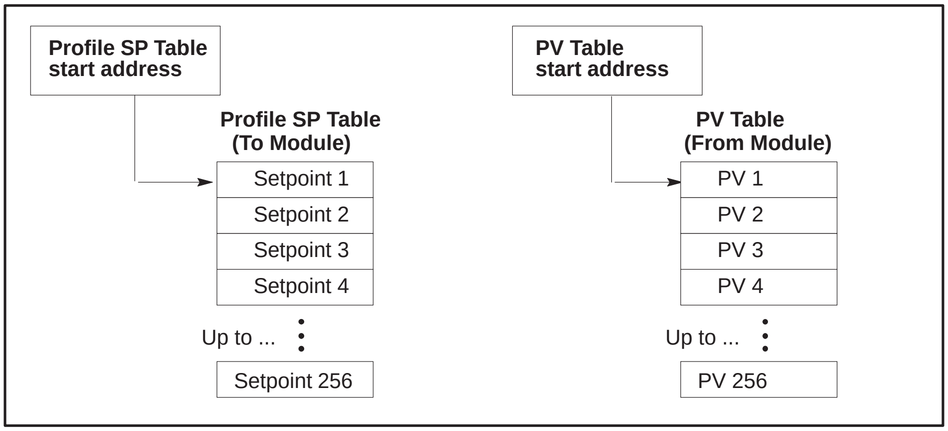


Figure 5-5 Profile SP and PV Tables

Monitoring Mandrel Position

The module enables you to compare the actual mandrel position to the profile data. To monitor the actual position, set up a table in V-memory into which the module writes the actual position (process variable) attained at the end of each profile step. This table is called the Process Variable (PV) Table.

Specify the starting address for the PV Table by entering an address into the **PV Table starting address** field in the Configuration Table. (Tables for the various profiles do not have to be contiguous.) During operation, the entire table of process variables is uploaded to the controller automatically by the module at the completion of a profile. If you enter zero into the **PV Table starting address** field, no table is uploaded for the corresponding profile.

The table length is automatically set to the same as that of the Profile SP Table. When you assign table addresses for the various data tables, be sure to allocate V-memory carefully so that no data can be overwritten.

5.2 Characteristics of Position-based Modes

In the position-based configuration, the module can:

- Control up to two dies (axes 1 and 2, closed-loop control) with automatic restart of the profile from the position input (Aux 5).
- Control up to four dies (axes 1-4, closed-loop control) and monitor the position of the accumulator ram.

Two-Head Operation with Accumulator Control (Mode 3)

When configured for two-head/accumulator control, the TurboParison module has the following characteristics.

- Up to two axes (axis 1 and axis 2) are available for profile control. The remaining two axes are available for accumulator control.
- The position and velocity of the accumulator ram determines when the module moves to the next profile step. The module monitors ram position to determine the profile step. In this mode, the module can also control accumulator push-out velocity.

Figure 5-6 shows a typical application of two-head/accumulator mode.

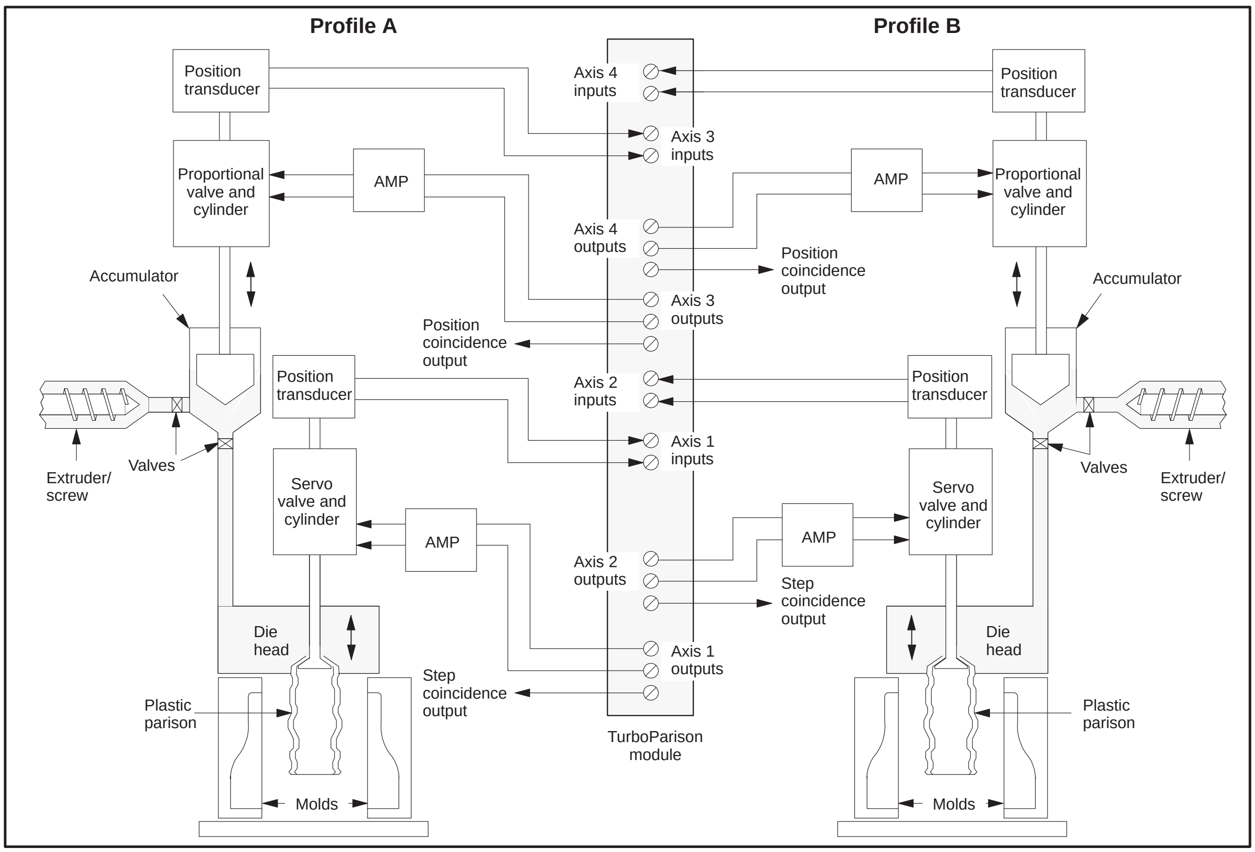


Figure 5-6 Example of Two-Head Operation with Accumulator Control

Four-Head Operation without Accumulator Control (Mode 4)

When configured for four-head/no accumulator control, the TurboParison module has the following characteristics.

- Up to four axes (axes 1 – 4) are available for profile control.
- Auxiliary input 5 monitors the position of the accumulator ram. The module does not perform push-out control. You must provide some other means, e.g., with the controller, to do this.

Figure 5-7 shows a typical application of four-head/no accumulator mode.

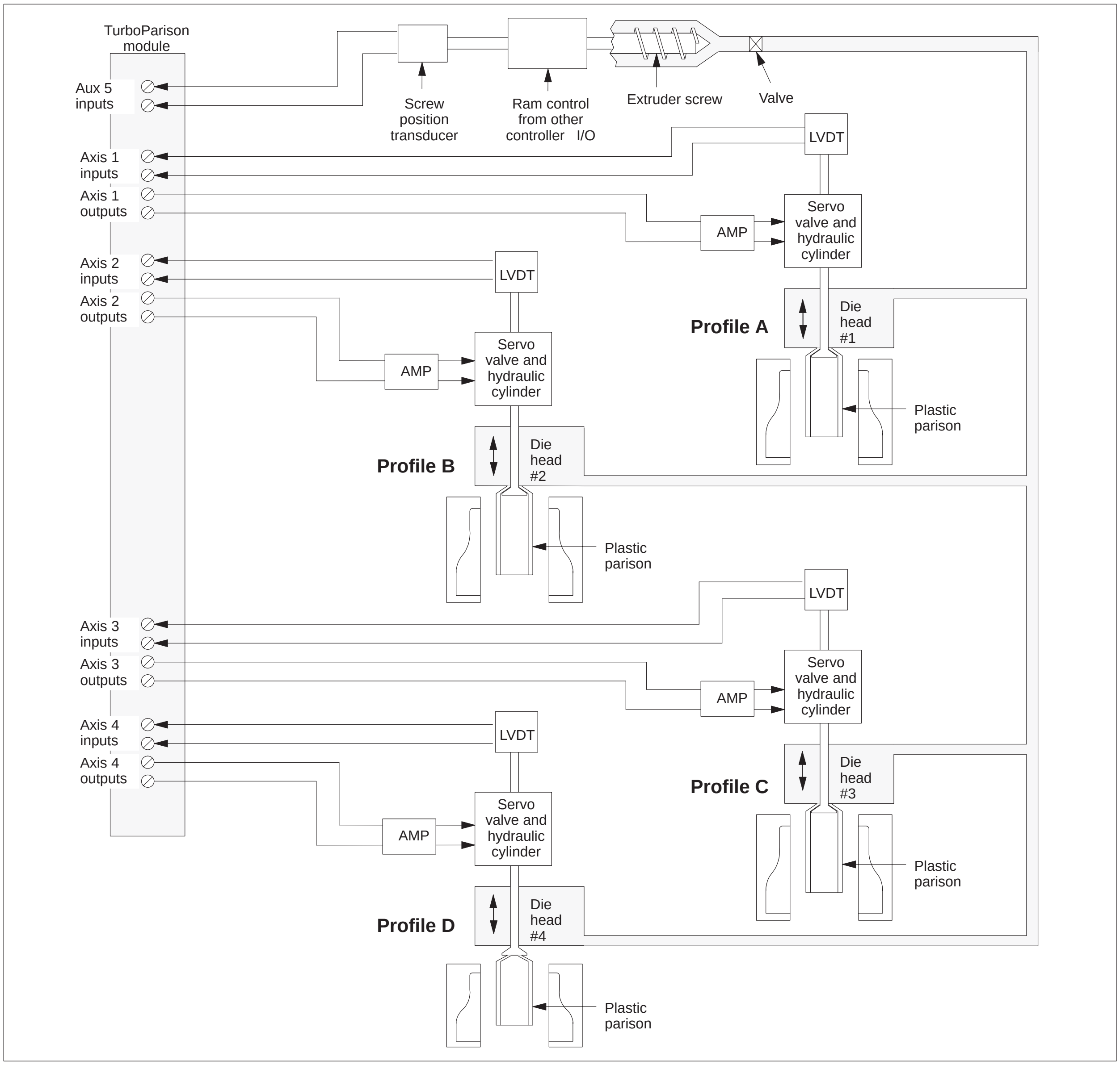


Figure 5-7 Example of Four-Head Operation without Accumulator Control

Two-Head Operation with Automatic Restart (Mode 5)

When configured for two-head operation with automatic restart, the TurboParison module has the following characteristics.

- One or two axes (axis 1 and axis 2) are available for profile control.
- Auxiliary input 5 monitors the position of the mold and restarts the parison profile for each new mold. Mold position control (speed of the wheel) is not provided by this module.

Figure 5-8 shows a timing example for a 4-mold wheel, illustrating the relationship between wheel position, input position ramp, and parison profile.

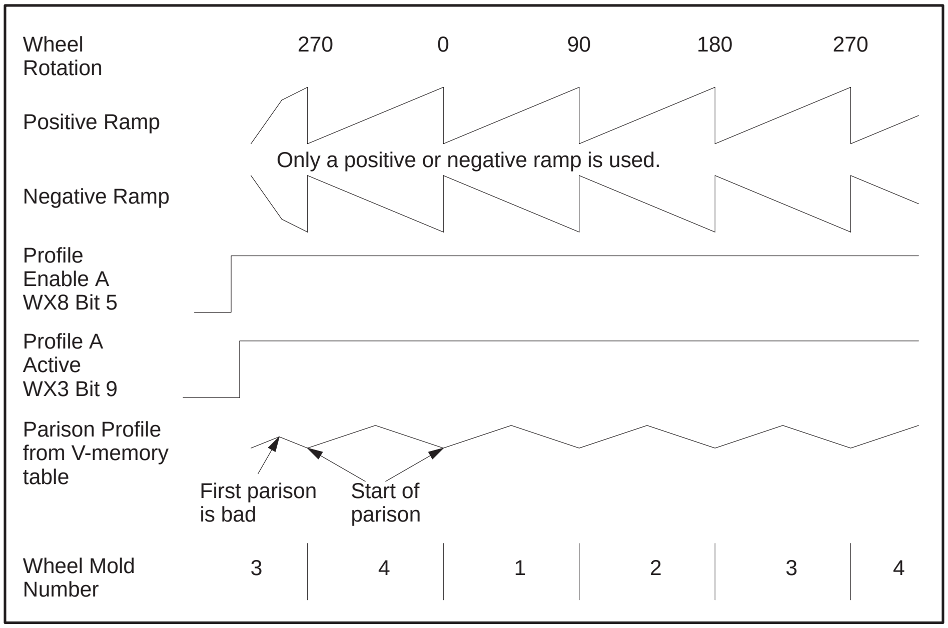


Figure 5-8 Timing Example for a 4-Mold Wheel

Figure 5-9 shows a typical application of two-head operation with automatic restart.

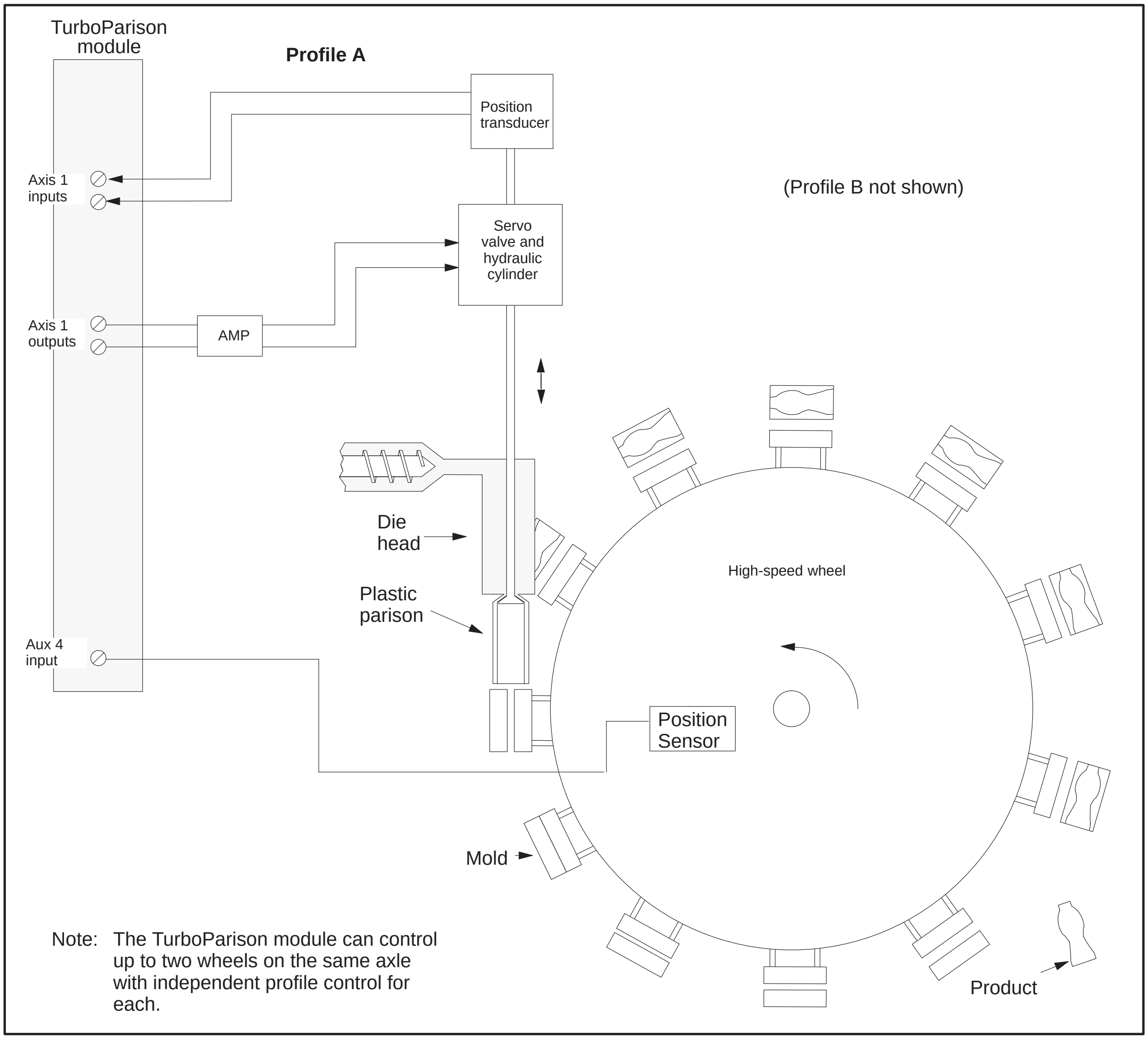


Figure 5-9 Two-Head Operation with Automatic Restart

Differences in Mode 5

Mode 5 is similar to position-based Mode 4, except that the profile automatically restarts when the position input returns to the profile starting value. This allows position control of the parison profile for continuous parison generation (when needed by the wheel machine). In this mode, the module expects the position input to be a saw-tooth waveform with the active part of the input representing the time it takes for the wheel to revolve by one mold. The active part of the input can have either a positive or negative slope.

- You select Mode 5 by setting switch 3 to closed and switches 1, 2, and 4 to open.
- The profile can have between 8 and 256 steps.

Polarity The polarity of the position input (Aux input 5) can be either positive or negative. Bit 8 in WY7 controls this feature: zero selects a positive ramp and one selects a negative ramp. This feature is only available in Mode 5.

Position Shift In Mode 5, you can shift the position of the parison relative to the Aux 5 input ramp. This allows you to adjust the position of the parison relative to a mold on the wheel. The range of this value is from –32000 to +32000 (0 = +32000 = –32000). For normal use, this value is from –16000 to +16000. A positive number delays the parison behind the position input ramp; a negative number advances the parison ahead of the position input ramp. The location of the position of the shift values follows:

Profile 1 position shift	WY5+182
Profile 2 position shift	WY5+183

This location is the same as the CH3 and CH4 Hold Value locations that are not used in Mode 5.

Span and Zero Adjustment Adjusting zero and span for the position input is critical for Mode 5 operation.

- The span must be less than the maximum ramp value (50 mv below maximum).
- Zero must be greater than the minimum ramp value (50 mv above minimum).

These conditions must be met in order so that the profile can move from step to step; otherwise it holds at one value.

5.3 Determining Module Configuration Parameters

As discussed in Chapter 3, the Configuration Table contains process parameters that determine the operation of the TurboParison module. The module uses these parameters to calculate loop variables, offsets, and other numeric values that are essential to Parison control.

To determine which parameters are available for use with the TurboParison module when operating it in position-based mode, refer to the following tables. For mode 3, refer to Table 5-1 and Table 5-2. For mode 4, refer to Table 5-3. Both modes use Table 5-4. The **bold** parameters are essential for proper operation.

Table 5-1 Configuration Table for Position-based Operation (Mode 3 Only)

V-memory offsets (WY5 + *offset*)		Parameter name	Valid values
Head A	Head B		
0	40	**Configuration word**	See description
1	41	T_s — loop sample time	1 to 32,767 milliseconds
2	42	Calibration zero for analog input	0 to 10,000 mV
3	43	Calibration span for analog input	0 to 10,000 mV
4	44	T_f — input filter time constant	0 to 32,767 milliseconds
5	45	Reserved	0
6	46	Reserved	0
7	47	**K_c — proportional gain constant**	0 to 327.67
8	48	**T_i — integral time constant**	0 to 32,767 milliseconds
9	49	T_d — derivative time constant	0 to 327.67 milliseconds
10	50	Output zero	–10,000 to +10,000 mV
11	51	Output span	–10,000 to +10,000 mV
12	52	**Profile Setpoint Table starting address**	0 to 65,000
13	53	**Profile Setpoint Table length**	2, 4, 8, 16, 32, 64, 128, 256
14	54	Process Variable Table starting address	0 to 65,000
15	55	Reserved	0
16	56	Purge value	0 to 32,000
17	57	Weight control	–32,000 to +32,000
18	58	Phase check location	0 to 255
19	59	Phase check setpoint	0 to 32,000
20	60	Number of steps to hold phase check	0 to 256
21	61	Reserved	0
22	62	Reserved	0
23	63	Profile time-out value	0 to 65,535 milliseconds
24	64	Profile step coincidence location	0 to 255
25	65	Number of steps to hold profile coincidence output	0 to 256
26–39	66–79	Reserved	0

Table 5-2 Configuration Table for Position-based Operation (Mode 3 Only)

V-memory offsets (WY5 + *offset*)		Parameter name	Valid values
Ram A	**Ram B**		
80	120	Configuration word	See description
81	121	T_s — loop sample time	1 to 32,767 milliseconds
82	122	Calibration zero for analog input	0 to 10,000 mV
83	123	Calibration span for analog input	0 to 10,000 mV
84	124	T_f — input filter time constant	0 to 32,767 milliseconds
85	125	Velocity scale factor	0 to 32,000 counts/mS
86	126	Shot size	0 to 32,000
87	127	**K_c — proportional gain constant**	0 to 327.67
88	128	**T_i — integral time constant**	0 to 32,767 milliseconds
89	129	T_d — derivative time constant	0 to 327.67 milliseconds
90	130	Output zero	–10,000 to +10,000 mV
91	131	Output span	–10,000 to +10,000 mV
92	132	**Velocity Setpoint Table starting address**	0 to 65,000
93	133	**Velocity Setpoint Table length**	2, 4, 8, 16, 32, 64, 128, 256
94	134	**Position Table starting address**	0 to 65,000
95–103	135–143	Reserved	0
104	144	Position coincidence location	0 to 32,000
105	145	Hold position coincidence on until	0 to 32,000
106–119	146–159	Reserved	0

Table 5-3 Configuration Table for Position-based Operation (Mode 4 Only)

V-memory offsets (WY5 + *offset*)				Parameter name	Valid values
Head A	**Head B**	**Head C**	**Head D**		
0	40	80	120	Configuration word	See description
1	41	81	121	T_s — loop sample time	1 to 32,767 milliseconds
2	42	82	122	Calibration zero for analog input	0 to 10,000 mV
3	43	83	123	Calibration span for analog input	0 to 10,000 mV
4	44	84	124	T_f — input filter time constant	0 to 32,767 milliseconds
5	45	85	125	Reserved	0
6	46	86	126	Reserved	0
7	47	87	127	**K_c — proportional gain constant**	0 to 327.67
8	48	88	128	**T_i — integral time constant**	0 to 32,767 milliseconds
9	49	89	129	T_d — derivative time constant	0 to 327.67 milliseconds
10	50	90	130	Output zero	–10,000 to +10,000 mV
11	51	91	131	Output span	–10,000 to +10,000 mV
12	52	92	132	**Profile Setpoint Table starting address**	0 to 65,000
13	53	93	133	**Profile Setpoint Table length**	2, 4, 8, 16, 32, 64, 128, 256
14	54	94	134	Process Variable starting address	0 to 65,000
15	55	95	135	Reserved	0
16	56	96	136	Purge value	0 to 32,000
17	57	97	137	Weight control	–32,000 to +32,000
18	58	98	138	Phase check location	0 to 255
19	59	99	139	Phase check setpoint	0 to 32,000
20	60	100	140	Number of steps to hold phase check	0 to 256
21	61	101	141	Reserved	0
22	62	102	142	Reserved	0
23	63	103	143	Profile time-out value	0 to 65,535 milliseconds
24	64	104	144	Profile step coincidence location	0 to 255
25	65	105	145	Number of steps to hold profile coincidence output	0 to 256
26–39	66–79	106–119	146–159	Reserved	0

Table 5-4 Configuration Table for Position-based Operation (All Modes)

V-memory offsets (WY5 + *offset*)	Parameter name	Valid values
160*	Calibration zero for analog input 5 (ram position)	0 to 10,000 mV
161*	Calibration span for analog input 5 (ram position)	0 to 10,000 mV
162	**Shot size** (Mode 4 only)	0 to 32,000
163–169	Reserved	0
170	Interpolation master table starting address	0 to 65,000
171	Interpolation calculated table starting address	0 to 65,000
172	Interpolation table length	2, 4, 8, 16, 32, 64, 128, 256
173	Interpolation method	0 – linear interpolation 1 – curvelinear interpolation
174	Starting address of original table	0 to 65,000
175	Length of original table	2, 4, 8, 16, 32, 64, 128, 256
176	Starting address of expanded table	0 to 65,000
177	Length of expanded table	2, 4, 8, 16, 32, 64, 128, 256
178–179	Reserved	0
180	Head A die gap (continuously downloaded)	0 to 32,000
181	Head B die gap (continuously downloaded)	0 to 32,000
182	Back pressure setting for profile A (mode 3) or Head C die gap (mode 4) (continuously downloaded)	0 to 32,000
183	Back pressure setting for profile B (mode 3) or Head D die gap (mode 4) (continuously downloaded)	0 to 32,000
184	Axis 1 manual override value (continually downloaded)	–32000 to +32000
185	Axis 2 manual override value (continually downloaded)	–32000 to +32000
186	Axis 3 manual override value (continually downloaded)	–32000 to +32000
187	Axis 4 manual override value (continually downloaded)	–32000 to +32000
188–199	Reserved	0

* Mode 4 and Mode 5 only

If a parameter value is zero, the module uses the default value. For detailed descriptions of the parameters and their default values, refer to Appendix B.

Determining Configuration Parameters

After you determine which parameters are required for your machine, turn to Appendix E and make a copy of the worksheets that correspond to the position-based mode. These worksheets enable you to record parameters and values that you intend to enter into the Configuration Table. These worksheets also help determine the amount of V-memory that must be set aside to operate the module.

Determining the V-Memory Required

Before entering the worksheet information into V-memory, determine the amount of memory to set aside to run your machine. For example, mode 3 requires from 2.5K to 3.0K bytes of V-memory.

To determine the amount of required V-memory, refer to the configuration worksheets and use that data to fill out the V-memory Allocation Worksheet found in Appendix E.

Entering Data into V-Memory

After setting aside the appropriate amount of V-memory, you are ready to enter the values from the worksheets into memory. To enter the configuration values from an operator interface, read the user manual for the operator interface. To enter the configuration values from TISOFT, follow these steps.

1. Run TISOFT and display the screen that allows you to edit V-memory.
2. Enter the values from the Configuration Table Worksheet into the V-memory locations listed on the worksheet.
3. If you do not have an operator interface, enter values for the Profile Setpoint Table, Velocity Setpoint Table, and Position Table now.

NOTE: If you change any values in the Configuration Table, Profile Setpoint Table, Velocity Setpoint Table, or Position Table while a profile is running, you must instruct the module to download the tables again before the changes can affect the operation of the module.

5.4 Preparing the Module for Operation

Before you operate the TurboParison module, complete and check off the following tasks.

✓ Set the dipswitches for the correct operational mode, set the voltage jumpers to match the voltage for your I/O devices, install the module in the base, and make the appropriate field connections to the front of the module. See Chapter 2.

✓ Run TISOFT and configure the controller I/O for the TurboParison module's location and type. After you log the module into the controller, determine the controller V-memory allocation requirements for your configuration. See Section 5.3.

✓ Determine the machine sequence for your process, and then write an RLL program to sequence the machine and interact with the module.

✓ Load the Configuration Table with the parameter values that correspond to the axis or axes. Appendix B lists and describes all of the available parameters.

✓ Ensure that all data relevant to your machine exists in the V-memory locations reserved for the Configuration Table, Profile Setpoint Table, Velocity Setpoint Table, and Position Table. These tables are automatically downloaded to the module when you place the module in RUN mode. See Section 5.5.

✓ Ensure that the dies are calibrated and tuned. Refer to Chapter 6 for information about calibrating and tuning die heads.

✓ Manually step the machine through its sequence before you run the RLL and sequence the machine automatically.

5.5 Operating the Module in Position-based Mode

Putting the Module in RUN Mode

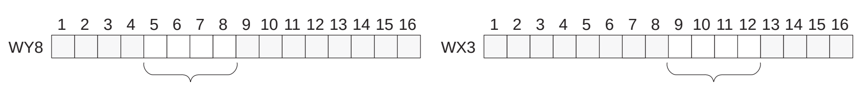
WY6 controls putting the module into RUN mode:

- Writing a value of 5000 hexadecimal (20480 decimal) in WY6 puts the module in RUN mode. All configuration information is automatically downloaded from the controller and the module enables all axis controllers. The module RUN light comes on and the RUN acknowledge bit (WX4 Bit 8) is set to 1.
- Writing a 0 to WY6 takes the module out of RUN mode. All analog outputs are forced to 0 V, all discrete outputs are turned off, the module RUN light turns off and the RUN acknowledge bit is reset to 0. This corresponds to an Emergency Stop (ESTOP) condition.

> **CAUTION**
>
> **Ensure that you do not require a controlled shutdown before you perform an ESTOP.**
>
> **If you do not initiate a controlled shutdown procedure before performing an ESTOP, you may cause equipment damage.**
>
> **It is to your advantage to shut down in a controlled manner before you perform an ESTOP.**

Enabling/Disabling Profile Execution

To start profile execution, set the corresponding profile enable bit in WY8 to 1. The module then sets a corresponding bit in WX3 to signify the profile is active. For mode 3, ram push-out also begins, and continues until End of Shot is reached. The module then resets the profile active bit in WX3 to 0. The setpoint remains at the last profile step until the profile enable bit in WY8 returns to 0. The setpoint returns to the die gap/hold value when the profile is disabled.



Enables Profile		**Module Response**	
Profile A	Bit 5	Profile A	Bit 9
Profile B	Bit 6	Profile B	Bit 10
Profile C	Bit 7	Profile C	Bit 11
Profile D	Bit 8	Profile D	Bit 12

See Appendix A for a complete description of WX/WY words and more information about profile operation.

5.6 Changing Configuration and Profile Data

To change data in the Configuration Table, Profile Setpoint Table, Velocity Setpoint Table, or Position Table, access the V-memory locations that you want to change and enter the new data. If you have an operator interface, access the parameters and/or setpoints with the screen and enter the new data.

Before any changes can become effective, however, you must download the tables from the controller to the module. When you place the module in RUN mode, the tables are automatically downloaded to the module. If the module is already in RUN mode and you make changes to one or more of the tables, your RLL program must instruct the module to download one or more of the tables.

The procedure outlined in Figure 5-10 shows you how to download the tables when the module is in RUN mode.

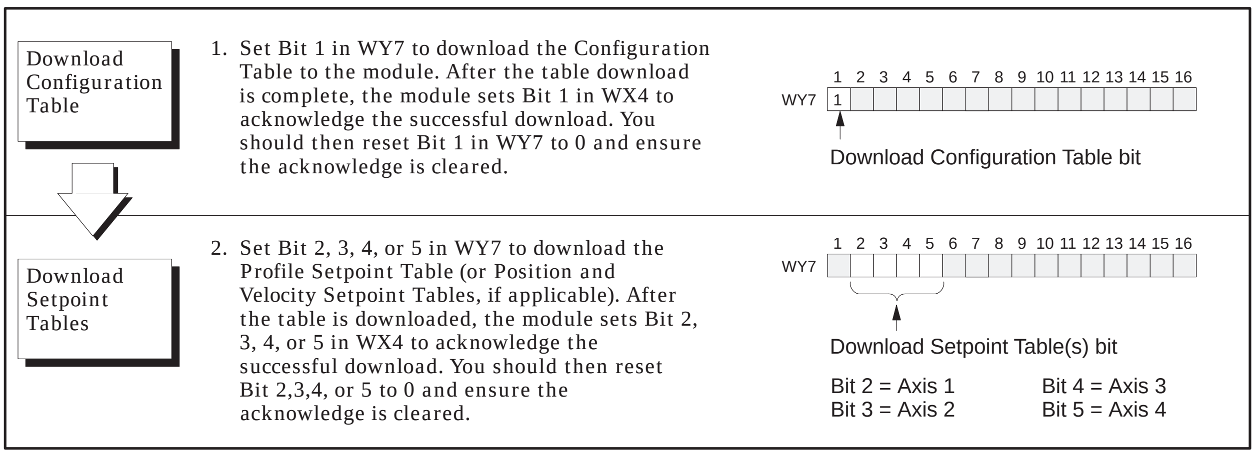


Figure 5-10 Downloading Tables in RUN Mode

5.7 Monitoring the Operation of the Module

The General Status Table enables you to monitor the operation of the module. This table consists of module-related data that is uploaded from the module to the controller. Like the Configuration Table, the parameters in the General Status Table are offset from the V-memory address specified by WY5. Table 5-5 shows the contents of the General Status Table.

Table 5-5 General Status Table Contents

V-memory offsets (WY5 + *offset*)	Parameter description
200	Current analog input from axis 1 (Head A)
201	Current analog input from axis 2 (Head B)
202	Current analog input from axis 3 (ram A or Head C)
203	Current analog input from axis 4 (ram B or Head D)
204	Current analog input from auxiliary input 5 (ram position mode 4 only)
205	Current PV for axis 1 (Head A)
206	Current PV for axis 2 (Head B)
207	Current PV for axis 3 (ram A velocity or Head C position)
208	Current PV for axis 4 (ram B velocity or Head D position)
209	Reserved
210	Current output for axis 1 (Head A)
211	Current output for axis 2 (Head B)
212	Current output for axis 3 (ram A or Head C)
213	Current output for axis 4 (ram B or Head D)
214	Current discrete inputs and outputs — Indicates the status of the discrete inputs and outputs. The word contained in this V-memory location has the following breakdown: MSB … LSB 1 2 3 4 | 5 6 7 8 | 9 10 11 12 | 13 14 15 16 **Bits 1–4** Dipswitch settings: these bits may be used by the RLL to verify that the dipswitch was set correctly. 0000 Mode 1 0001 Mode 2 0010 Mode 3 0011 Mode 4 0100 Mode 5 **Bit 5** At shot size for profile B **Bit 6** At end of shot for profile B **Bit 7** At shot size for profile A **Bit 8** At end of shot for profile A **Bits 9–12** Discrete output is on for the following: Bit 9 step coincidence for profile A Bit 10 step coincidence for profile B Bit 11 position coincidence for ram A/step coincidence for profile C Bit 12 position coincidence for ram B/step coincidence for profile D **Bit 13–16** Discrete input is on for the following: Bit 9 input 1 (not typically used for position-based operation) Bit 10 input 2 (not typically used for position-based operation) Bit 11 input 3 (not typically used for position-based operation) Bit 12 input 4 (not typically used for position-based operation)

Table 5-5 General Status Table Contents (continued)

V-memory offsets (WY5 + *offset*)	Parameter description
215	Broken transmitter alarm — Indicates whether a broken transmitter alarm is on for one or more of the axes. MSB … LSB: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 Bits 1 through 12 are not used. Bit 13 corresponds to die D/ram B (axis 4) Bit 14 corresponds to die C/ram A (axis 3) Bit 15 corresponds to die B (axis 2) Bit 16 corresponds to die A (axis 1)
216	Last profile time for profile A
217	Last profile time for profile B
218	Last profile time for profile C
219	Last profile time for profile D
220	Reserved
221	Reserved
222	Reserved
223	Reserved
224	Weight correction for profile A
225	Weight correction for profile B
226	Weight correction for profile C
227	Weight correction for profile D
228	Current setpoint for axis 1 (Head A)
229	Current setpoint for axis 2 (Head B)
230	Current setpoint for axis 3 (ram A)
231	Current setpoint for axis 4 (ram B)
232 – 299	Reserved

Chapter 6

Calibration and Loop Tuning

6.1 Overview

Areas of Control

Figure 6-1 shows the various areas of control for calibration and tuning.

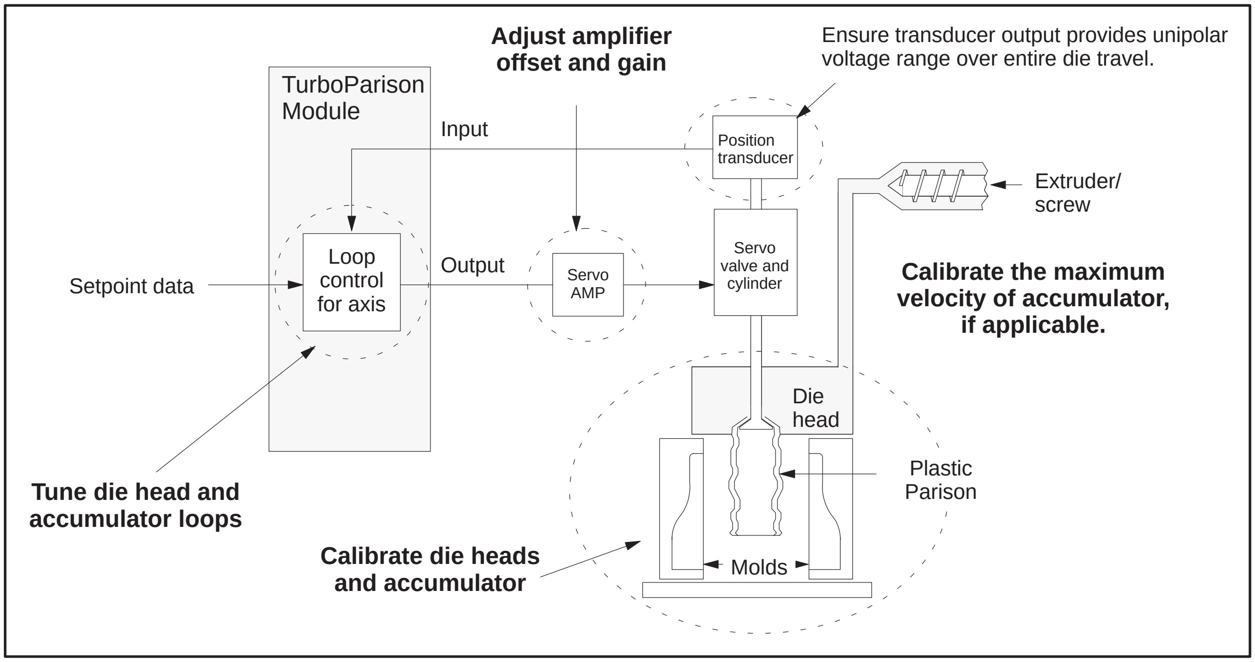


Figure 6-1 Areas of Control for Calibration and Tuning

For dies, the calibration process involves raising or lowering the mandrel and setting the zero value and the span value. See Figure 6-2.

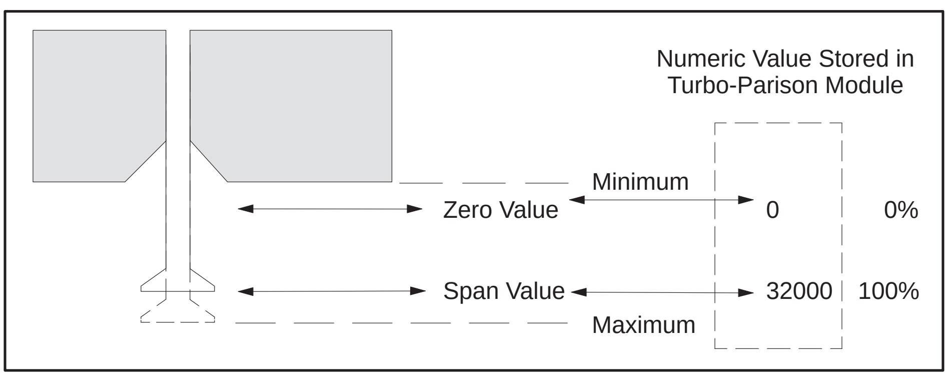


Figure 6-2 Calibrating Zero and Span Values

Using Open-Loop vs. Closed-Loop Mode for Calibration

Setting the module to open-loop control in effect bypasses the loop controller and places the axis into manual operation. Closed-loop control allows the loop controller to determine the output level, based on feedback from the process. See Figure 6-3. Select open- or closed-loop mode in the axis configuration word. (See Chapter 3.)

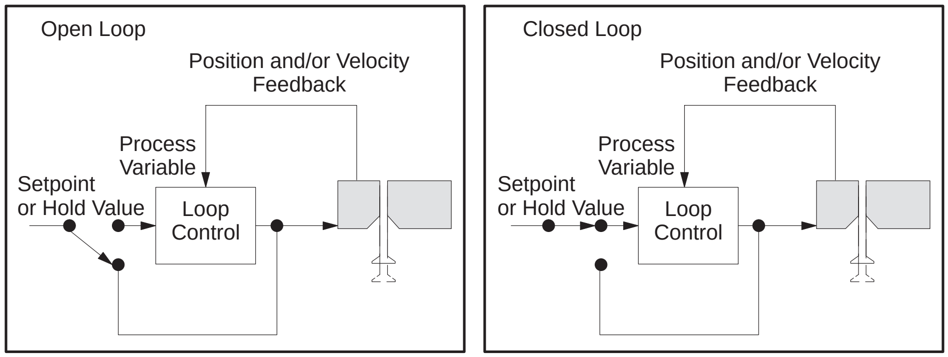


Figure 6-3 Open-Loop vs. Closed-Loop Control

- Advantage of Configuring in Closed-Loop Mode. If your tooling must be calibrated to precise positions — rather than to maximum/minimum positions — closed-loop mode provides accurate control of mechanical position. For example: if you set the mandrel halfway between zero and span and then moved the mandrel up 0.120″, the feedback into the loop controller would hold the mandrel in position. (In open-loop mode, the mandrel may drift.)
- Advantage of Configuring in Open-Loop Mode. Calibration in open-loop mode is less complicated: you set the output feeding the servo amplifier, and the mandrel moves to a mechanical stop. Always calibrate rams in open-loop mode.

⚠ CAUTION

Large output signal levels can cause damage to your equipment if the mandrel is overdriven into the mechanical limits.

Use small output signal values to move the mandrel. Use small percentage increments (less than 5%) when moving the mandrel to mechanical limits.

To avoid equipment damage, ensure that you use percentages of less than 5% when you move the mandrel to mechanical limits.

During operation, die heads are typically run in closed-loop mode, while rams are run in either open-loop or closed-loop, based on the equipment and process requirements.

Overview (continued)

General Guidelines

Consider the following guidelines when calibrating or tuning your process.

✓ When calibrating dies in closed-loop mode, use an initial setpoint value of 50%. This ensures the setpoint falls within the zero and span range, avoiding potential for the output trying to drive the mandrel beyond some mechanical stop in an attempt to achieve setpoint.

✓ Entering 10000 for span in the Configuration Table defines the maximum voltage (either +10 V or +5 V, selected by jumper settings). If the 0–5 V range was selected, entering 10000 defines the maximum output voltage to be +5 V; entering 5000 defines the maximum voltage to be +2.5 V (50% of jumper selection, not 5000 mV).

✓ When calibrating rams, always use open-loop (manual control) to move ram to the zero position; fill accumulator with plastic to move ram to span position.

✓ Inputs on the TurboParison module are unipolar (0 V to +5 V or +10 V). Ensure that feedback signals to the module inputs are within the unipolar input range throughout the entire stroke. If feedback device is a bipolar LVDT either:

 Use the unipolar (e.g., 0 V to +10 V) range of the stroke, or

 Install a signal conditioner to convert voltages from bipolar to unipolar.

✓ When setting zero and span values, leave a small gap between the zero/span value and the minimum and maximum range of the mandrel. This helps to avoid potential equipment damage caused by a mandrel overshooting the zero or span location.

✓ You can set zero and span for outputs in the Configuration Table. (Reference Appendix B)

✓ In CALIBRATE mode, the new zero and span values are stored during calibration; exiting from CALIBRATE mode writes the new zero and span values to the Configuration Table (overwriting the previous entries).

✓ If the module is not in RUN mode or CALIBRATE mode, outputs are driven to 0 V.

6.2 Adjusting the Offset and Gain for Valve Amplifiers

Adjusting Offset

Use the following steps to set the amplifier offset.

1. Put the module into open-loop, manual control (see description of configuration word in Appendix B).
2. Set the hold value to 0; this drives the outputs to the zero output value. (The module constantly scans this value; you do not need to download the Configuration Table.) Adjust the amplifier until there is zero current output, or until the mandrel does not creep in either direction. (For proportional amplifiers, see manufacturer's specifications.)

NOTE: If you plan on using closed-loop push-out and your proportional valve amplifier has ramping control, ensure ramping is disabled to achieve optimum performance.

Adjusting Gain

Typically, the TurboParison module requires minimal amplifier gain-setting. (Refer to manufacturer's specifications for the amplifier.) Ensure that the maximum voltage from the module drives the amplifier such that the valve is at full open, or maximum flow is achieved.

NOTE: After initially setting gain for the amplifiers, you can modify loop performance or system response by adjusting loop-tuning parameters (stored in V-memory) and save as part of a recipe. See Section 6.6. You do not need to adjust amplifier gain to modify performance.

6.3 Calibrating the Die Heads

Overview

For die heads, the calibration process typically involves raising or lowering the mandrel and setting the zero and span value. See Figure 6-4.

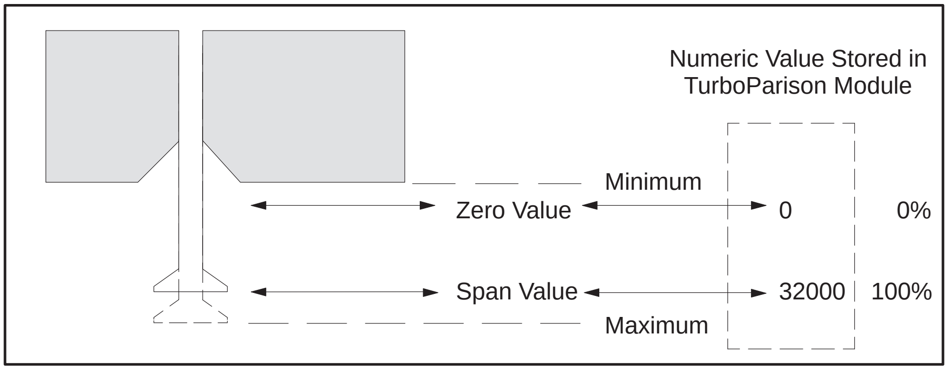


Figure 6-4 Calibrating Zero and Span Values

> **⚠ CAUTION**
>
> **Leave a small gap between the zero/span value and the minimum and maximum range of the mandrel when setting zero and span values.**
>
> **Doing this ensures that you avoid equipment damage caused by a mandrel overshooting the zero or span location.**
>
> **Ensure that you leave the gap when you set the zero and span values.**

Converging vs. Diverging Tooling

Tooling affects calibration. Figure 6-5 shows the mandrel positions for both types of tooling during calibration. Zero value (0) corresponds to the closed tooling position; span value (32000) corresponds to the open tooling position. Keep these factors in mind when you calibrate the module.

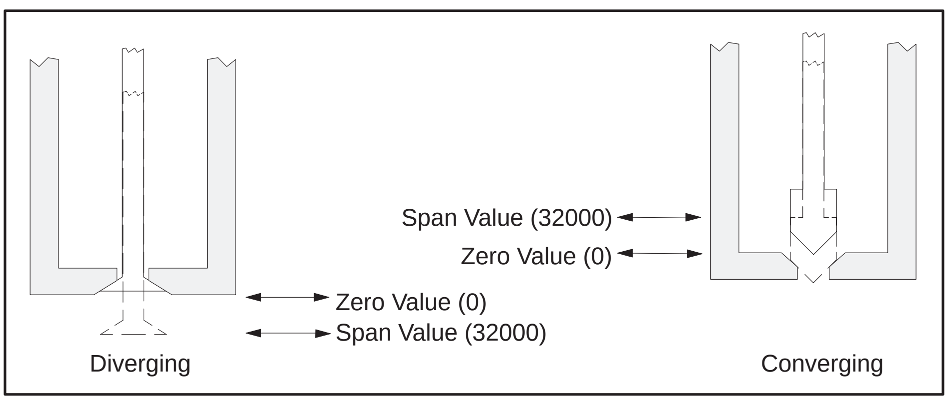


Figure 6-5 Die Positions for Diverging and Converging Tooling

Selecting Tooling Type

Selecting the proper loop operational mode is essential when changing tooling type. Figure 6-6 assumes that applying positive voltage to the servo amplifier moves the die upward. If your tooling type is converging, select direct acting loop control; if tooling type is diverging, select reverse acting loop control. Select direct or reverse acting control by manipulating Bit 15 in the configuration word (0 = direct, 1 = reverse; see Appendix B).

NOTE: If your system is set up opposite from this example (i.e., applying positive voltage to the servo amplifier moves the die downward), you should swap the direct/reverse acting selection shown.

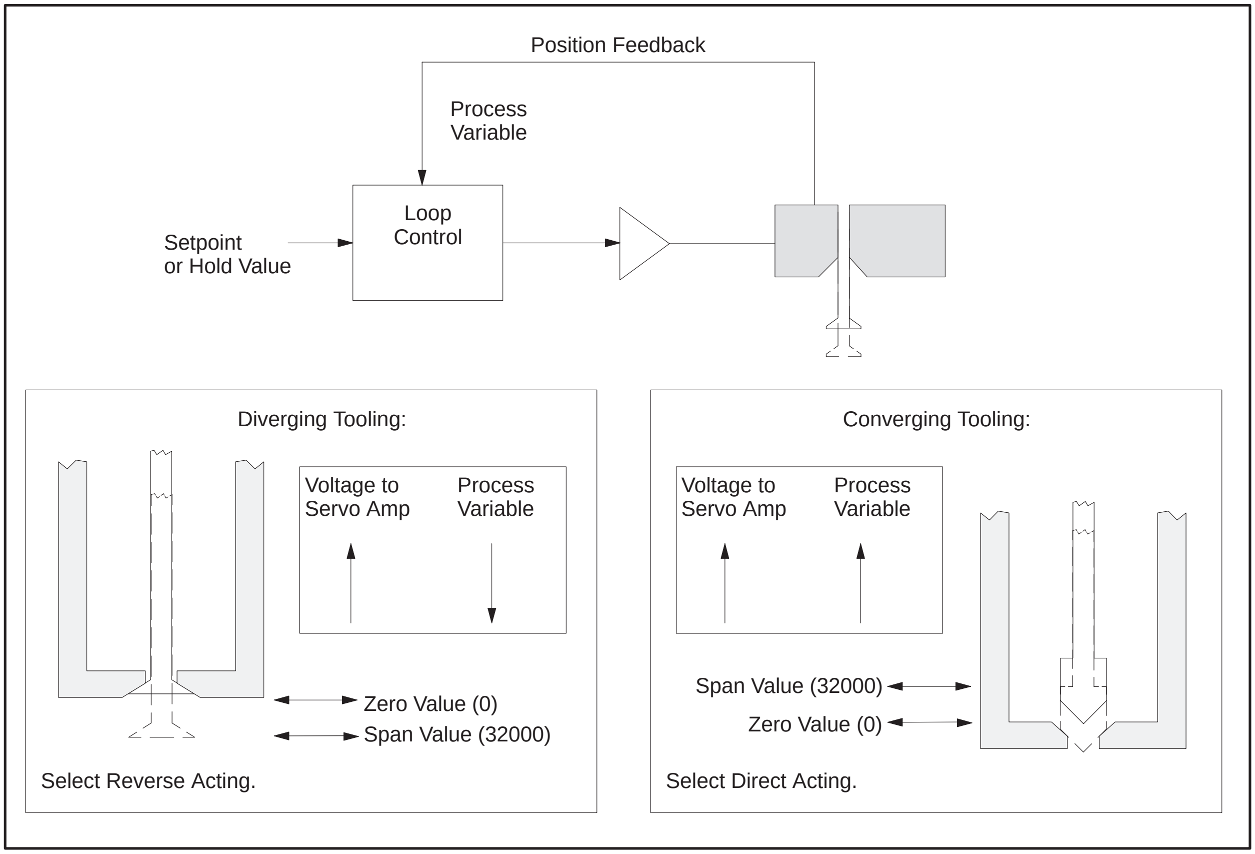


Figure 6-6 Selecting Tooling Type

General Guidelines

Consider the following guidelines when calibrating die heads. Figure 6-7 shows the basic steps required for calibrating die heads in open-loop mode.

- ✓ Entering 10000 for span in the Configuration Table defines the maximum voltage (either +10 V or +5 V, selected by jumper settings). If the 0–5 V range was selected, entering 10000 defines the maximum output voltage to be +5 V; entering 5000 defines the maximum voltage to be +2.5 V (50% of jumper selection, not 5000 mV).
- ✓ When setting zero and span values, leave a small gap between the zero/span value and the minimum and maximum range of the mandrel. This helps to avoid potential equipment damage caused by a mandrel overshooting the zero or span location.

Dies heads are typically calibrated in open-loop mode. If your application requires using closed-loop mode for calibration (for example, calibrating tooling to precise locations rather than to maximum and minimum positions), consider the following guidelines. (Refer also to Figure 6-7.)

- ✓ Drive the controller setpoint to mid-value by setting the hold value (die gap setting) to 16000 (50%).
- ✓ Select either reverse- or direct-acting loop action, depending on tooling type.
- ✓ Open the calibration limits to allow tooling travel over the entire range by setting Calibrate Zero to 0 and Calibrate Span to 10000 (10 V) for direct-acting (or set Calibrate Zero to 10000 and Calibrate Span to 0 for reverse acting).
- ✓ If tuning parameters have not yet been established, set them to be very loose (e.g., K_c = 0.25 and T_i = 1000).
- ✓ After putting the axis in closed loop mode and enabling calibration, move tooling by incrementing or decrementing the hold value (die gap setting).

⚠ CAUTION

Inputs to the Turbo-Parison modules are unipolar (0 to +10 V); using negative voltages may cause improper operation.

Improper operation can cause damage to your equipment.

Use only positive voltage as input from position transducers to monitor the position of the mandrel.

Put module in CALIBRATE mode.

1. Set the calibration enable bit (bit 13) in WY6 to **1**.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
WY6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

Calibration enable bit (bit 13)

Select an axis for calibration.

2. Set bits 10 through 12 in WY6 to one of the values listed below.

001 = Axis 1
010 = Axis 2
011 = Axis 3
100 = Axis 4
101 = Aux 5

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
WY6	0	0	0	0	0	0	0	0	0				1	0	0	0

Set the zero calibration limit.

3. After setting the mandrel to the closed position, set bit 14 in WY6 to **1**. The module reads the analog input for the specified axis and records the zero value. The module then sets the zero calibration status bit in WX3 to **1** if the operation was successful.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
WY6	0	0	0	0	0	0	0	0	0				1	1	0	0

Low limit bit (bit 14)

4. Set bit 14 of WY6 to **0** when the status bit in WX3 indicates a successful zero calibration. When you set bit 14 to **0**, the module clears the status bit in WX3.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
WY6	0	0	0	0	0	0	0	0	0				1	0	0	0

Low limit bit (bit 14)

Set the span calibration limit.

5. After setting the mandrel to the open position, set bit 15 in WY6 to **1**. The module reads the analog input for the specified axis and records the span value. The module then sets the span calibration status bit in WX3 to **1** if the operation was successful.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
WY6	0	0	0	0	0	0	0	0	0				1	0	1	0

High limit bit (bit 15)

6. Set bit 15 of WY6 to **0** when the status bit in WX3 indicates a successful high limit calibration. The module then clears the status bit in WX3.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
WY6	0	0	0	0	0	0	0	0	0				1	0	0	0

High limit bit (bit 15)

Calibrate remaining axes.

7. Repeat steps 2 through 6 to calibrate the remaining axes.

Exit CALIBRATE mode.

8. Set bit 13 of WY6 to **0**. The module checks the calibration data. If the limits are valid, they are written to the appropriate V-memory locations in the Configuration Table. If the limits are invalid (e.g., Zero = Span), the previous calibration data remains in effect, and the calibration error status bit in WX3 is set to **1**.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
WY6	0	0	0	0	0	0	0	0	0				0	0	0	0

Calibration enable bit (bit 13)

Figure 6-7 Die Head Calibration Procedure

6.4 Calibrating Rams

Calibrating Ram Position

Calibrating rams is a process of first defining the End of Shot position (zero value), filling the accumulator with plastic (moving the ram), and defining the span value. See Figure 6-8.

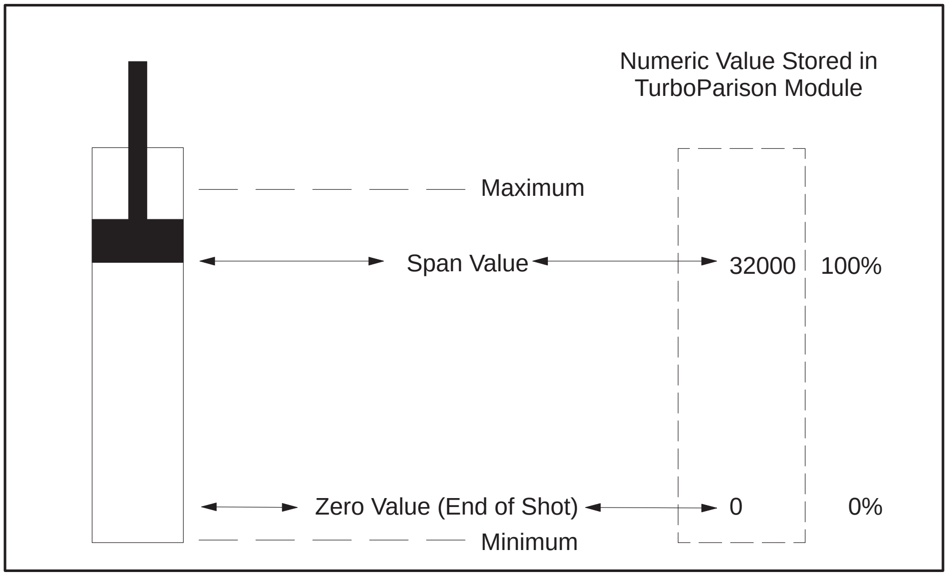


Figure 6-8 Calibrating Zero and Span Values

Zero corresponds to the End of Shot position; span corresponds to the ultimate fill position. Leave some margin between the zero/span positions and the minimum/maximum as shown. Keep these factors in mind when you calibrate the module.

Guidelines

Figure 6-9 shows the basic steps required for calibrating rams. Consider also the following guidelines.

✓ Entering 10000 for output span in the Configuration Table defines the maximum voltage (either +10 V or +5 V, selected by jumper settings). If the 0–5 V range was selected, entering 10000 defines the maximum output voltage to be +5 V; entering 5000 defines the maximum voltage to be +2.5 V (50% of jumper selection, not 5000 mV).

✓ Configure your amplifiers and valves so that positive voltage shoots plastic.

Put module in CALIBRATE mode.

1. Set the calibration enable bit (bit 13) in WY6 to **1**.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
WY6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

Calibration enable bit (bit 13)

Select an axis for calibration.

2. Set bits 10 through 12 in WY6 to one of the values listed below.

   001 = Axis 1
   010 = Axis 2
   011 = Axis 3
   100 = Axis 4
   101 = Aux 5

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
WY6	0	0	0	0	0	0	0	0	0				1	0	0	0

Set the zero calibration limit.

3. After setting the ram to the zero (End of Shot) position, set bit 14 in WY6 to **1**. The module reads the analog input for the specified axis and records the zero value. The module then sets the zero calibration status bit in WX3 to **1** if the operation was successful.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
WY6	0	0	0	0	0	0	0	0	0				1	1	0	0

Low limit bit (bit 14)

4. Set bit 14 of WY6 to **0** when the status bit in WX3 indicates a successful zero calibration. When you set bit 14 to **0**, the module clears the status bit in WX3.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
WY6	0	0	0	0	0	0	0	0	0				1	0	0	0

Low limit bit (bit 14)

Set the span calibration limit.

5. After setting the ram to the span position, set bit 15 in WY6 to **1**. The module reads the analog input for the specified axis and records the span value. The module then sets the span calibration status bit in WX3 to **1** if the operation was successful.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
WY6	0	0	0	0	0	0	0	0	0				1	0	1	0

High limit bit (bit 15)

6. Set bit 15 of WY6 to **0** when the status bit in WX3 indicates a successful high limit calibration. The module then clears the status bit in WX3.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
WY6	0	0	0	0	0	0	0	0	0				1	0	0	0

High limit bit (bit 15)

Calibrate remaining axes.

7. Repeat steps 2 through 6 to calibrate the remaining axes.

Exit CALIBRATE mode.

8. Set bit 13 of WY6 to **0**. The module checks the calibration data. If the limits are valid, they are written to the appropriate V-memory locations in the Configuration Table. If the limits are invalid (e.g., zero = span), the previous calibration data remains in effect, and the calibration error status bit in WX3 is set to **1**.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
WY6	0	0	0	0	0	0	0	0	0				0	0	0	0

Calibration enable bit (bit 13)

Figure 6-9 Ram Calibration Procedure

Calibrating Maximum Ram Velocity

The automatic maximum velocity calibration feature calculates the value of the velocity scaling factor (VSF), which is entered in the **velocity scale factor** field of the configuration table. The VSF determines the maximum velocity of the ram, measured in counts (0–32000) per second.

To use this feature, you must purge at full velocity (open-loop). The module monitors the position of the moving ram for one second, determines the proper velocity scale factor, and writes the factor to the Configuration Table. Use the following procedure to calibrate maximum ram velocity.

1. Put the module in CALIBRATE mode.
2. Select an axis for calibration.
3. With the ram traveling at its maximum attainable velocity, set Bit 16 in WY6.
4. The module responds approximately one second later by setting Bit 16 in WX4. This indicates the operation was successful.
5. Set Bit 13 in WY6 to zero to take the module out of CALIBRATE Mode. Calibration data is automatically written to the Configuration Table.

If you prefer to set the maximum velocity manually, use TISOFT or your operator interface to enter the maximum velocity directly into the Velocity Scale Factor field in the Configuration Table.

6.5 Calibrating Aux 5 Input in Mode 5

Description of the Calibration Process

The TurboParison does not provide automatic calibration of the Aux 5 input in mode 5. Follow the procedures described below to calibrate Aux 5 input in mode 5.

To set the span on the Aux 5 input:

1. Determine the maximum voltage from the wheel position sensor.
2. Convert this number to integer millivolts.
3. Subtract 50 from the number.
4. Enter the number in V-memory location WY5 + 161.

To set the zero on the Aux 5 input:

1. Determine the minimum voltage from the wheel position sensor.
2. Convert this number to integer millivolts.
3. Add 50 to the number.
4. Enter the number in V-memory location WY5 + 160.

Example of the Calibration Process

Maximum voltage reading 9.65 V
Minimum voltage reading 0.45 V
Convert to integer millivolts: 9.65 = 9650; 0.45 = 0450
Subtract 50 from the maximum reading: 9650 – 50 = 9600
Enter 9600 in location WY5 + 161.
Add 50 to the minimum reading: 0460 + 50 = 500
Enter 500 in location WY5 + 160.

Determine the minimum and maximum voltage by rotating the wheel to the positions where these values are output by the position sensor. (These two values are very close to each other during the rotation of the wheel.) If you can rotate the wheel slowly enough, you can use a controller-interrupt routine to determine the minimum and maximum values that are seen at the Aux 5 input.

6.6 Tuning Loops

Description

The TurboParison module uses Proportional Integral Derivative (PID) control. PID controllers can be tuned by using three different parameters, the proprotional gain, integral time constant, and derivative time constant. These parameters are stored in the Configuration Table for each axis.

Adjusting the loop tuning parameters effects system performance: adjust your tuning parameters to provide the desired response for your process. Figure 6-10 shows relationships between loop-tuning philosophies and the response of process value to setpoint change.

⚠ CAUTION
A die can overshoot the zero or span location. **Die overshoot can cause damage to your equipment.** **To help avoid potential equipment damage caused by a die overshooting the zero or span location, leave a small gap between the zero/span value and the minimum and maximum range of the die when setting zero and span values.**

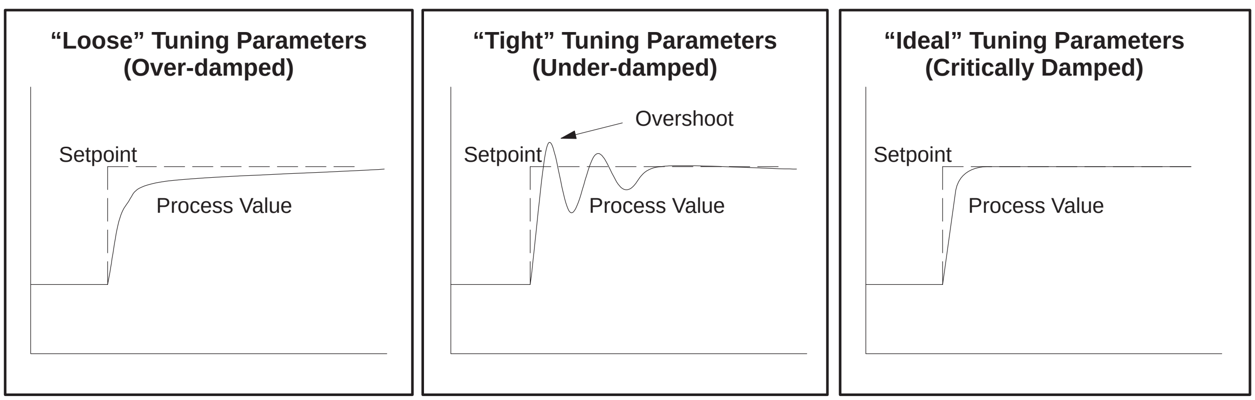


Figure 6-10 Loop Response

Typical Tuning Parameters for Die Heads

Table 6-1 shows typical loop parameter values for tuning die response, where K_c is the proportional gain constant, and T_i is the integral time constant in milliseconds.

Table 6-1 Typical Loop Tuning Parameters for Dies

Large Machines (Dies as heavy as 15 lb. or more)		
"Loose" Tuning Values	K_c = 0.5	T_i = 1000
"Tight" Tuning Values	K_c = 2.0	T_i = 300
Shuttle and Wheel Machines		
"Loose" Tuning Values	K_c = 0.5	T_i = 500
"Tight" Tuning Values	K_c = 4.0	T_i = 200

Guidelines for Tuning Loops

Create a step-change program for toggling setpoint:

✓ To aid in monitoring system response to changes in loop-tuning parameters, program a step change in the setpoint (e.g., from 20% to 40%). Toggling the setpoint helps show the effects of adjusting the loop parameters.

Turn off derivative action (T_d):

✓ Set $T_d = 0$.

(Derivative action has not been found useful for most motion loops.)

Determine proportional gain (K_c):

✓ Start with a small proportional gain and no integral action (e.g., $K_c = 0.25$ and $T_i = 0$).

(Although using a smaller number for T_i results in more integral action, setting $T_i = 0$ results in no integral action.)

✓ Double the proportional gain (K_c) until you see a slight oscillation when the setpoint step change occurs (the tooling may chatter and settle out). After you notice the oscillation, reduce K_c by half.

Determine integral action (T_i):

✓ After determining the proportional gain (K_c), introduce integral action by using a large number for T_i (e.g., $T_i = 10000$). Reduce T_i by half until you see a slight oscillation when the setpoint step change occurs. After you notice the oscillation, double T_i.

For additional tuning:

✓ After determining approximate values for K_c and T_i, you can fine-tune system response by incrementing loop parameters by nominal amounts (less than 10%).

✓ You can also fine-tune a machine profiling parisons. Assure that any fine-tuning parameters entered are capable of controlling the most difficult profiless run on that machine.

Chapter 7

Using the Module's Optional Features

7.1 Interpolation and Expansion of Profile Data

Overview

The TurboParison module can interpolate master profile setpoints using either linear or curvilinear interpolation. It also has the capability to expand a profile with fewer steps into one having finer resolution. You may use these features in conjunction with one another or separately. The following explains the procedures.

Interpolation

The interpolation feature (Figure 7-1) allows you to interpolate between master points in a profile. You do this by copying the master points into a master table you created in V-memory. The calculated points are stored in a second table, called the calculated table, that you can then copy into any of the other data tables. The starting address and table lengths of the master and calculated tables are stored in the Configuration Table.

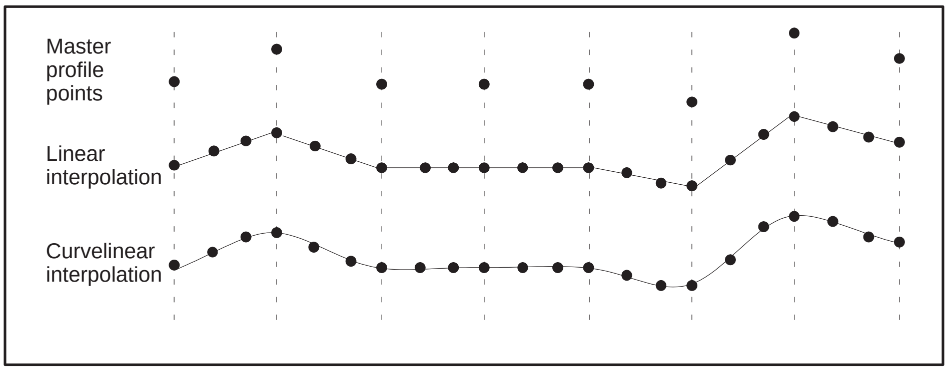


Figure 7-1 Interpolation Example

You can interpolate any set of data, e.g., the profile setpoints, ram position values, etc., by copying the set of data into the master table, interpolating the data, and then copying the interpolated values into the proper location for runtime operations. Two algorithms are available:

- The linear interpolation algorithm determines the equation of a straight line between adjacent points in the master table. All intervening points that lie along this line are determined. The process is repeated for each pair of points in the table.
- The curvilinear interpolation algorithm develops a set of cubic polynomial equations, one for each area lying between two points in the master table. Adjacent equations pass through the master point between them, making the curve smooth and continuous.

To use the interpolation feature, copy the master setpoints into the master table (non-master points should be zero). When you command the module to interpolate, it downloads the master table and interpolates the data. The module stores the resulting interpolated data in the calculated table in the controller. See Figure 7-2.

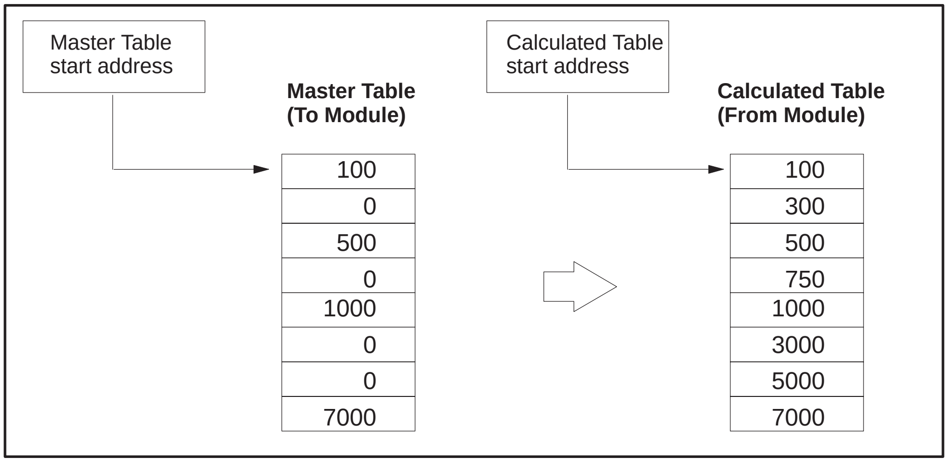


Figure 7-2 Interpolating Data

The V-memory addresses for the master and calculated tables are stored in the Configuration Table. See Figure 7-3. Select the interpolation method by entering **0** for linear or **1** for curvilinear in the interpolation method field. Be sure to download the Configuration Table after performing this initial setup. After initial setup is complete, interpolate data by performing the procedure outlined in Figure 7-4.

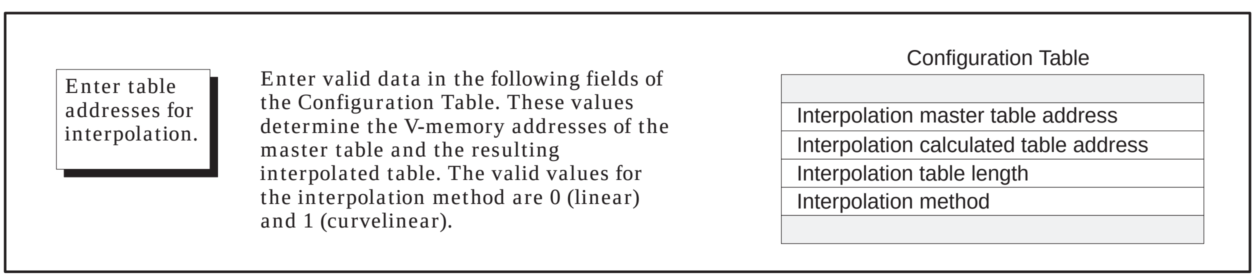


Figure 7-3 Setting Up Interpolation Options

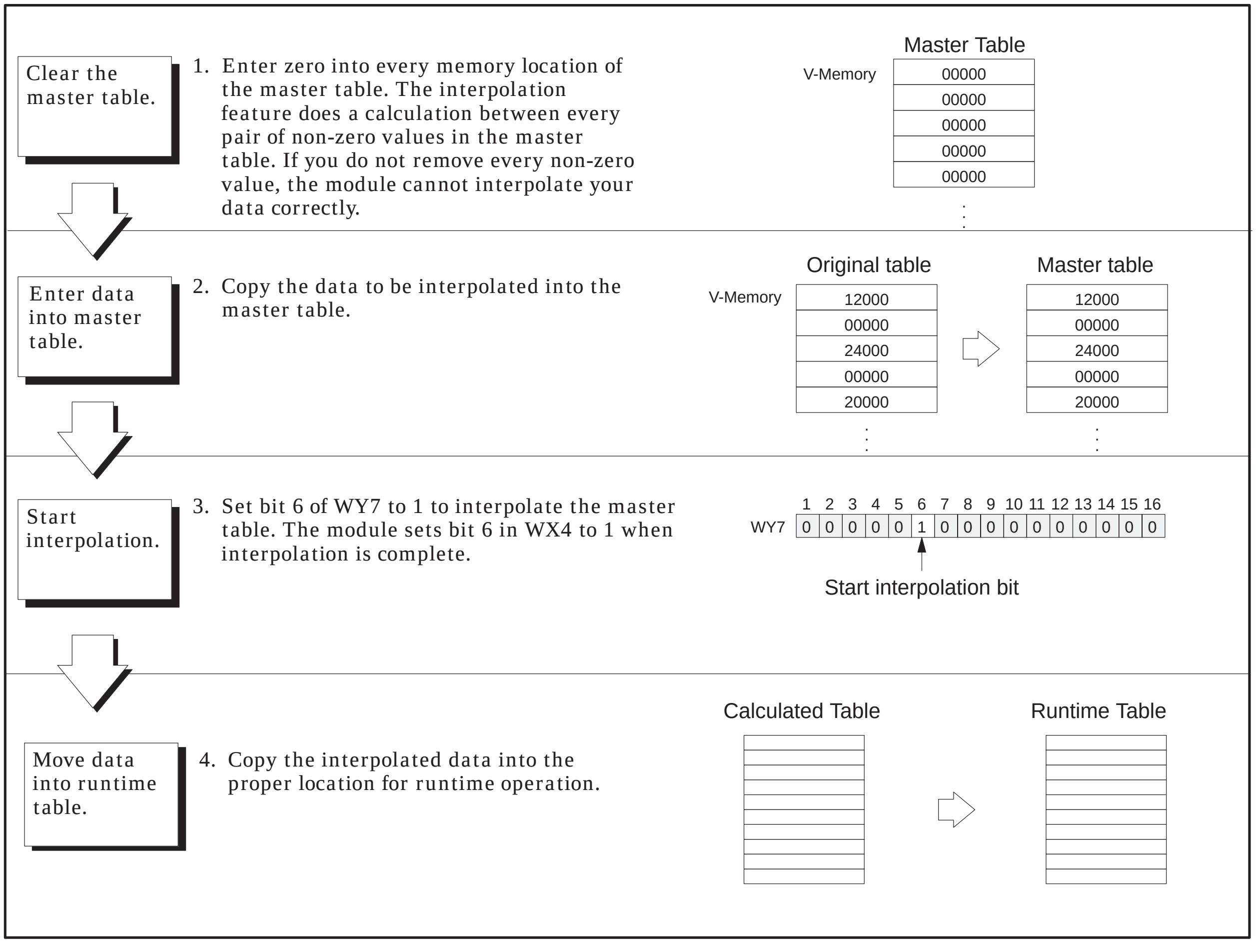


Figure 7-4 Interpolation Procedure

Table Expansion

You can also expand a table before interpolating it. The table expansion feature (Figure 7-5) allows you to increase the number of entries in a table automatically in order to increase the resolution of a profile.

To expand a table, create an original table in V-memory and reserve another area in V-memory to store the expanded table. Store the starting addresses and table lengths in the Configuration Table. When you send the command to expand the table, the module copies the original table into the expanded table, filling in the intervening points with zeroes. You can then use the interpolation feature to calculate the intervening points.

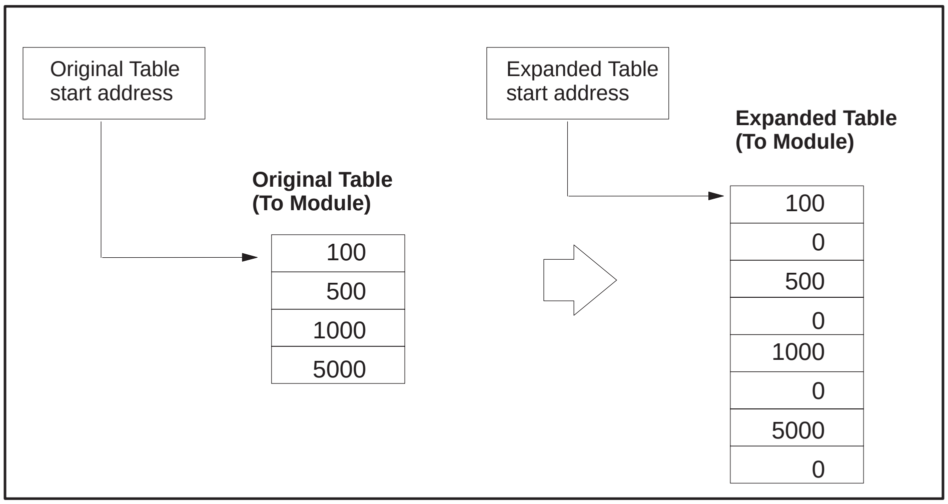


Figure 7-5 Expanding Tables

The V-memory addresses and corresponding table lengths for the original and expanded tables are stored in the Configuration Table. Be sure to download the Configuration Table after performing this initial setup. After initial setup is complete, you can expand the table by setting Bit 7 in WY7 to 1. When the expansion is complete, the module sets Bit 7 in WX4 to 1. You can then copy the expanded table into the master table and interpolate it. (See section on Interpolation.)

7.2 Automatically Maintaining the Weight of the Parison

Description

The automatic weight control feature allows you to make small changes in the profile setpoints without altering the total weight of the parison.

After you have adjusted the profile setpoints to provide adequate parison quality and have adjusted the weight control value to provide appropriate parison weight, enable automatic weight control done by setting the automatic weight enable bits in WY7. The module then calculates a mean weight W_t for the parisons, based on the profile setpoints, according to the following equation:

$$W_t = \frac{\sum_{n=1}^{N} (\text{Setpoints})}{N}$$

The module then compensates for any further changes that you make in the profile setpoints by adding a weight correction factor to the profile so that W_t does not change.

As long as the automatic weight control is enabled, the module provides a weight correction factor, in addition to the weight control value in the configuration table, that holds W_t constant when a new profile setpoint table is downloaded.

Figure 7-6 shows how the module handles a modified profile when the automatic weight control feature is enabled. The module calculates the weight correction factor to maintain the overall part weight.

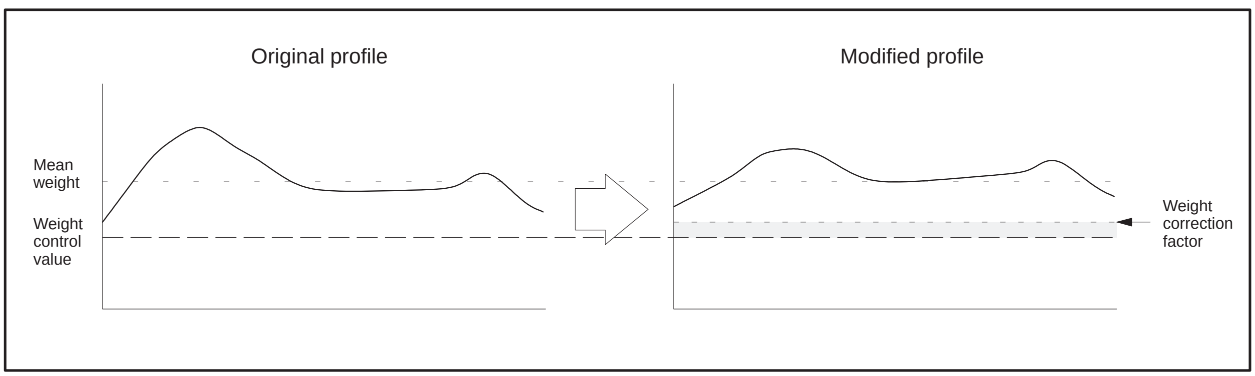


Figure 7-6 Automatic Weight Control Example

To monitor the value of the weight correction factor, have your RLL read the Weight Correction field in the General Status Table. This field must correspond to the profile you are modifying.

Procedure

To initiate automatic weight control, follow these steps.

1. Ensure that the profile setpoints (Profile Setpoint Table) and the weight control value (configuration table) are approximately correct. Also ensure that the overall part weight is close to your required value.

2. Enable automatic weight control by setting the appropriate bit in WY7 to one. See Table 7-1.

Table 7-1 Automatic Weight Control Enable Bits (WY7)

Bit(s) set	Description
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Automatic weight control is enabled when Bits 13 through 16 are set to 1

After the bit is set, the module determines the mean weight of the corresponding profile. If any changes are made to the profile, the module adds a positive or negative weight correction factor to the profile.

NOTE: When you first enable the automatic weight control feature, you will not notice any changes in the profile. Before any changes can occur, the Profile Setpoint Table must be downloaded again to the module.

You can make changes to the Profile Setpoint Table and as long as the automatic weight control is enabled, the module calculates a weight correction factor whenever it reads the Profile Setpoint Table.

7.3 Using the Module's Discrete Outputs

Description

Each axis of the module has a corresponding, discrete output that you can use to control a discrete device or application, (e.g., ink jet) to mark parison. Figure 7-7 illustrates how the module produces a discrete output signal for both modes of operation. The step coincidence output is based on the profile step affecting the die position, and the position coincidence output is based on the ram position.

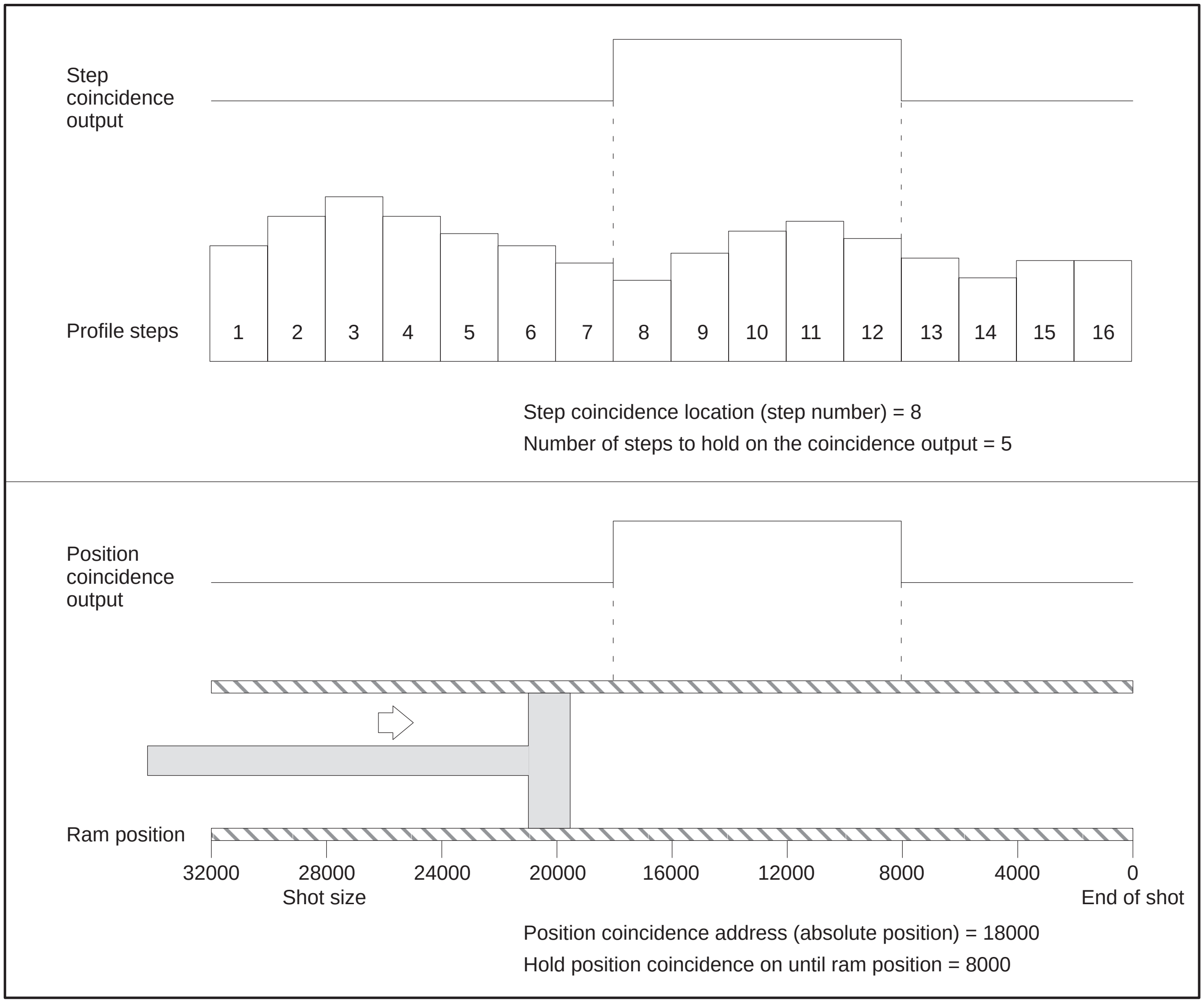


Figure 7-7 Discrete Output Generation

Procedure

To generate a discrete output signal for either a die or ram, enter values into the following fields in the Configuration Table.

For a die:

- Profile Step Coincidence Location — this field specifies the step within the Profile Setpoint Table where the discrete output transitions from off to on.
- Number of Steps To Hold Profile Coincidence Output — this field specifies the number of steps to hold on the discrete output.

For a ram:

- Position Coincidence Location — this field specifies the position of the ram where the discrete output transitions from off to on.
- Hold Position Coincidence on Until — this field specifies the ram position at which the discrete output transitions from on to off.

All values you enter in these fields are downloaded to the module when the Configuration Table is downloaded. If you make changes to these values, you must download the configuration table (see Appendix B).

7.4 Checking the Phase Between a Profile and a Parison

Description

The phase check feature enables you to determine what section of a parison corresponds to a step or range of steps in the associated profile.

Figure 7-8 shows a typical application of the phase check feature.

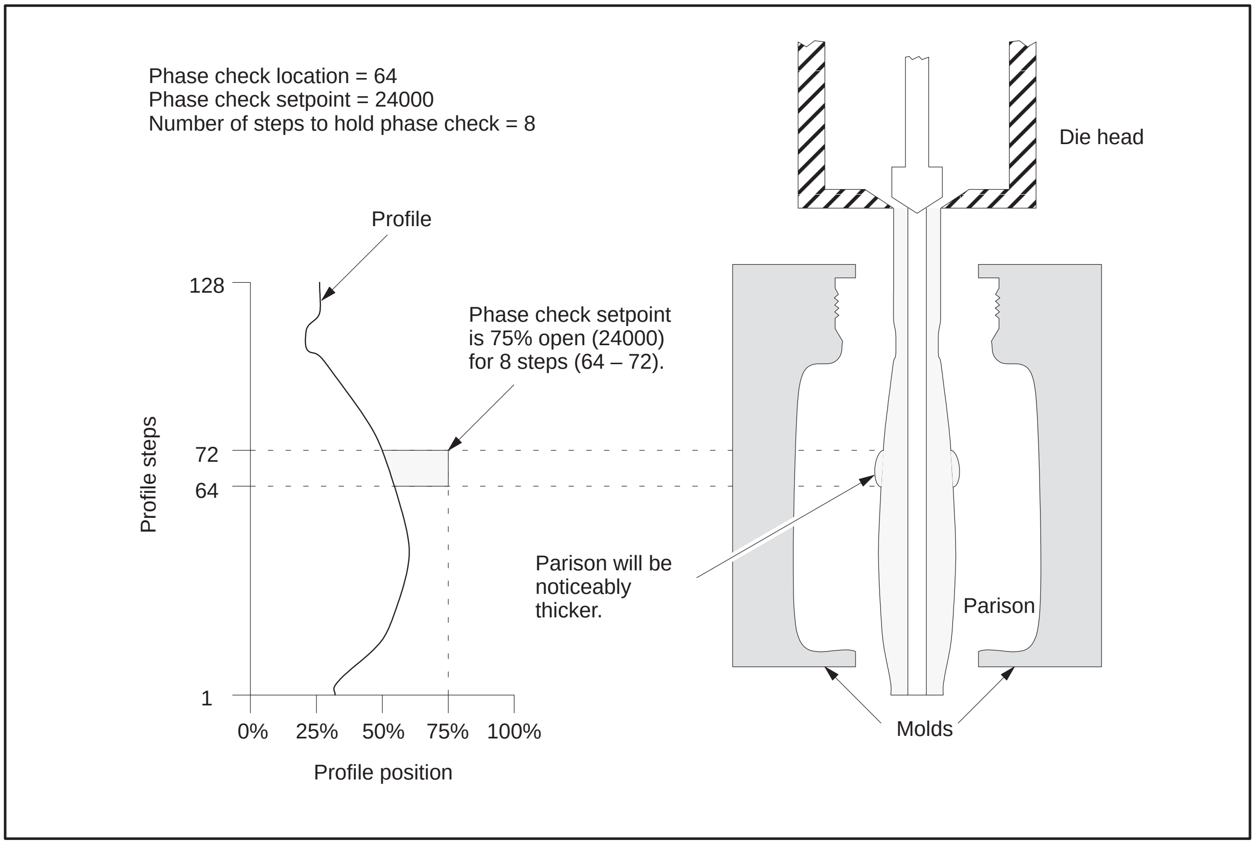


Figure 7-8 Phase Check Example

Procedure

To use the phase check feature, enter values into the following fields in the Configuration Table.

- Phase Check Location — this field specifies the profile step (or range of steps) where the phase check should start
- Phase Check Setpoint — this field specifies the setpoint at which the die should be set to mark the parison
- Number of Steps To Hold Phase Check — this field specifies the number of profile steps that the die should remain at the specified setpoint

All values you enter in these fields are downloaded to the module when the Configuration Table is downloaded. If you make changes to these values, you must download the Configuration Table (see Appendix B).

Appendix A
WX/WY Word Descriptions

A.1 Overview

This appendix describes the bits in the WX/WY words used by the TurboParison module. The WX input words represent data sent to the controller from the TurboParison module. The WY output words represent data sent from the controller to the module. The WX/WY words contain commands, error codes, and status information.

Figure A-1 shows the bit layout for both types of words. The most significant bit is Bit 1, and the least significant bit is Bit 16.

MSB															LSB
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Figure A-1 Bit Map for WX and WY Words

A.2 WX Words

WX1: Current Profile Execution Step for Axes 1 and 3

Bit(s) set	Description
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Bits 1 through 8 report the value of the current profile execution step for axis 3 (die head C or ram A).. Step 0 refers to the first entry in the Setpoint Table.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Bits 9 through 16 report thy value of the current profile execution step for axis 1 (die head A). Step 0 refers to the first entry in the Setpoint Table.

WX2: Current Profile Execution Step Axes 2 and 4

Bit(s) set	Description
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Bits 1 through 8 report the value of the current profile execution step for axis 4 (die head D or ram B). Step 0 refers to the first entry in the Setpoint Table.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Bits 9 through 16 report the value of the current profile execution step for axis 2 (die head B). Step 0 refers to the first entry in the Setpoint Table.

WX3: Handshaking, Error, and Status Information

Bit(s) set	Description
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Illegal pointer — Bit 1 indicates that an illegal starting address has been specified for WY5 or within the Configuration Table.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Illegal data — Bit 2 indicates that illegal data exists in the Configuration Table. This error usually occurs when a table parameter is out of the specified range. In most cases, the module uses the default parameter value and continues to operate.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Calibration error — Bit 3 indicates that a calibration error occurred. For example, the low calibration limit may equal the high calibration limit. The module clears this bit when the calibration process completes successfully.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Fatal error — Bit 4 indicates that a fatal error occurred.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Profile *x* time-out — Bits 5 through 8 indicate that the accumulated time from the start of profile 1 (bit 5), 2 (bit 6), 3 (bit 7), or 4 (bit 8) exceeded the profile time-out value specified in the Configuration Table. For time-based operation, the module resets this bit when the next sync pulse occurs. For position-based operation, the module resets the bit when the next RUN command is issued.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Profile *x* active — Bits 9 through 12 indicate that profile 1 (bit 9), 2 (bit 10), 3 (bit 11), or 4 (bit 12) is active. For time-based operation, this bit indicates the condition of the RUN command bit set in WY8. For position-based operation, this bit is set by the RUN command bit in WY8 and is reset at the end of the cycle
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Profile *x* automatic weight acknowledge — Bits 13 through 16 indicate that the automatic weight enable command bit in WY8 has been set and the weight basis has been calculated for profile 1 (bit 13), 2 (bit 14), 3 (bit 15), or 4 (bit 16). The acknowledge bit remains set until you turn off the corresponding automatic weight enable command bit in WY8.

WX Words (continued)

WX4: Handshaking, Error, and Status Information

Bit(s) set	Description
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Configuration Table download complete — Bit 1 indicates that the Configuration Table has been downloaded to the module.
1 **2** 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Axis 1 setpoint table download complete — Bit 2 indicates that the Profile Setpoint Table for axis 1 has been downloaded to the module.
1 2 **3** 4 5 6 7 8 9 10 11 12 13 14 15 16	Axis 2 setpoint table download complete — Bit 3 indicates that the Profile Setpoint Table for axis 2 has been downloaded to the module.
1 2 3 **4** 5 6 7 8 9 10 11 12 13 14 15 16	Axis 3 setpoint table download complete — Bit 4 indicates that either the Profile Setpoint Table (profile control) for axis 3 has been downloaded to the module or the Position and Velocity Setpoint Tables (accumulator control) for axis 3 have been downloaded to the module.
1 2 3 4 **5** 6 7 8 9 10 11 12 13 14 15 16	Axis 4 setpoint table download complete — Bit 5 indicates that either the Profile Setpoint Table (profile control) for axis 3 has been downloaded to the module or the Position and Velocity Setpoint Tables (accumulator control) for axis 3 have been downloaded to the module.
1 2 3 4 5 **6** 7 8 9 10 11 12 13 14 15 16	Interpolation complete — Bit 6 indicates that an interpolation command request is complete. This bit is reset when you turn off the interpolation command bit in WY7.
1 2 3 4 5 6 **7** 8 9 10 11 12 13 14 15 16	Table expansion complete — Bit 7 indicates that a table expansion command request is complete. This bit is reset when you turn off the expand table command bit in WY7.
1 2 3 4 5 6 7 **8** 9 10 11 12 13 14 15 16	Module in RUN mode — Indicates the module is in RUN mode.
1 2 3 4 5 6 7 8 **9** 10 11 12 13 14 15 16	Profile 1 PV Table upload in progress — Bit 9 indicates that the PV Table for profile 1 is being uploaded to the controller.
1 2 3 4 5 6 7 8 9 **10** 11 12 13 14 15 16	Profile 2 PV Table upload in progress — Bit 10 indicates that the PV Table for profile 2 is being uploaded to the controller.
1 2 3 4 5 6 7 8 9 10 **11** 12 13 14 15 16	Profile 3 PV Table upload in progress — Bit 11 indicates that the PV Table for profile 3 is being uploaded to the controller.
1 2 3 4 5 6 7 8 9 10 11 **12** 13 14 15 16	Profile 4 PV Table upload in progress — Bit 12 indicates that the PV Table for profile 4 is being uploaded to the controller.
1 2 3 4 5 6 7 8 9 10 11 12 **13** 14 15 16	Calibration mode — Bit 13 indicates that the module is currently in the CALIBRATION mode. The module remains in this mode until you turn off the calibrate enable bit in WY6.
1 2 3 4 5 6 7 8 9 10 11 12 13 **14** 15 16	Calibration Zero limit set — Bit 14 indicates that the zero limit for an input has been calibrated. The module must be in the CALIBRATE mode before this bit is valid. The module resets this bit when you turn off the set zero limit command bit in WY6.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 **15** 16	Calibration Span limit set — Bit 15 indicates that the span limit for an input has been calibrated. The module must be in the CALIBRATE mode before this bit is valid. The module resets this bit when you turn off the set span limit command bit in WY6.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 **16**	Calibration maximum velocity set — Bit 16 indicates that the maximum velocity for inputs connected to an enabled differentiating block has been set. The module must be in the CALIBRATE mode before this bit is valid. The module resets this bit when you turn off the set maximum velocity bit in WY6.

A.3 WY Words

WY5: Configuration Table Starting Address

This word determines the first V-memory location of the Configuration Table. Refer to Appendix B for more information about this table.

WY6: Module Operational Mode

Bit(s) set	Description
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Reserved.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Set module to the RUN mode. Both bits must = 1, all others must be 0 (hexadecimal 5000, decimal 20480).
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Reserved.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Use Bits 10, 11, and 12 to select axis input for calibration. 0 0 1 = Select Input 1 0 1 0 = Select Input 2 0 1 1 = Select Input 3 1 0 0 = Select Input 4 1 0 1 = Select Input 5
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Set module to the CALIBRATE mode.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Set the low limit during calibration.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Set the high limit during calibration.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Set the maximum velocity for a ram, during calibration.

WY Words (continued)

WY7: Miscellaneous Function Control

Bit(s) set	Description
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Download the configuration table.
1 **2** 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Download profile setpoint table for axis 1.
1 2 **3** 4 5 6 7 8 9 10 11 12 13 14 15 16	Download profile setpoint table for axis 2.
1 2 3 **4** 5 6 7 8 9 10 11 12 13 14 15 16	Download profile setpoint table for axis 3 (profile control) *or* Download position and velocity tables for axis 1 (ram control).
1 2 3 4 **5** 6 7 8 9 10 11 12 13 14 15 16	Download profile setpoint table for axis 4 (profile control) *or* Download position and velocity tables for axis 2 (ram control).
1 2 3 4 5 **6** 7 8 9 10 11 12 13 14 15 16	Interpolate data.
1 2 3 4 5 6 **7** 8 9 10 11 12 13 14 15 16	Expand table.
1 2 3 4 5 6 7 **8** 9 10 11 12 13 14 15 16	Mode 5 polarity bit
1 2 3 4 5 6 7 8 **9** **10** **11** **12** 13 14 15 16	Manual mode override enable
1 2 3 4 5 6 7 8 9 10 11 12 **13** 14 15 16	Enable auto-weight control for axis 1.
1 2 3 4 5 6 7 8 9 10 11 12 13 **14** 15 16	Enable auto-weight control for axis 2.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 **15** 16	Enable auto-weight control for axis 3.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 **16**	Enable auto-weight control for axis 4.

WY8: Profile Operation Control

Bit(s) set	Description
1 **2** **3** **4** 5 6 7 8 9 10 11 12 13 14 15 16	Force profile SP to purge value specified in configuration table. Profile 1 is controlled by bit 1, profile 2 by bit 2, profile 3 by bit 3, and profile 4 by bit 4. Purge takes precedence over RUN.
1 2 3 4 **5** **6** **7** **8** 9 10 11 12 13 14 15 16	When module is in RUN mode, enables profile 1 (bit 5) profile 2 (bit 6) profile 3 (bit 7) or profile 4 (bit 8). Time-based systems and Mode = 5: Profile is enabled when bit = 1. Position-based systems: Profile is enabled on the rising edge when bit transitions from 0 to 1.
1 2 3 4 5 6 7 8 **9** **10** **11** **12** 13 14 15 16	Force profile SP to phase check value when the current profile SP step matches the step in the **phase check location** field of the configuration table. Profile 1 is controlled by bit 9, profile 2 by bit 10, profile 3 by bit 11, and profile 4 by bit 12.
1 2 3 4 5 6 7 8 9 10 11 12 **13** **14** **15** **16**	Provides internal synchronization pulse (rising edge) for axis 1 (bit 13), axis 2 (bit 14), axis 3 (bit 15), or axis 4 (bit 16) in time-based systems. External synchronization inputs must be grounded or disconnected. If external synchronization inputs are used, then bits 13–16 must be set = 0.

Appendix B

Configuration Table Data

B.1 Configuration Tables for Time-based Operation

Table B-1 Configuration Table for Time-based Operation (Axes 1, 2, 3, and 4)

V–Memory offsets (WY5 + *offset*)				Parameter name	Valid values
Axis 1	Axis 2	Axis 3*	Axis 4*		
0	40	80	120	Configuration word	N/A
1	41	81	121	T_s — loop sample time	1 to 32,767 milliseconds
2	42	82	122	Calibration zero for analog input	0 to 10,000 mV
3	43	83	123	Calibration span for analog input	0 to 10,000 mV
4	44	84	124	T_f — input filter time constant	0 to 32,767 milliseconds
5	45	85	125	Reserved	0
6	46	86	126	$P_{t\ initial}$ — Initial profile time	0 to 65,535 milliseconds
7	47	87	127	K_c — proportional gain constant	0 to 327.67
8	48	88	128	T_i — integral time contant	0 to 32,767 milliseconds
9	49	89	129	T_d — derivative time constant	0 to 327.67 milliseconds
10	50	90	130	Output zero	–10,000 to +10,000 mV
11	51	91	131	Output span	–10,000 to +10,000 mV
12	52	92	132	Profile setpoint table starting address	0 to 65,000
13	53	93	133	Profile setpoint table length	2, 4, 8, 16, 32, 64, 128, 256
14	54	94	134	Process variable table starting address	0 to 65,000
15	55	95	135	Sync delay (phase shift) time	0 to 65,535 milliseconds
16	56	96	136	Purge value	0 to 32,000
17	57	97	137	Weight control	–32,000 to +32,000
18	58	98	138	Phase check location	0 to 255
19	59	99	139	Phase check setpoint	0 to 32,000
20	60	100	140	Number of steps to hold phase check	0 to 256
21	61	101	141	Profile time calculation method	0, 1, 2, 3
22	62	102	142	Number of cycles needed to average profile time	2, 4, 8, 16
23	63	103	143	Profile time-out value	0 to 65,535 milliseconds
24	64	104	144	Profile step coincidence location	0 to 255
25	65	105	145	Number of steps to hold profile coincidence output	0 to 256
26–39	66–79	106–119	146–159	Reserved	0

* Mode 2 only.

Table B-2 Configuration Table for Time-based Operation (Auxiliary Input 5)

V–Memory offsets (WY5 + *offset*)	Parameter name	Valid values
160	Calibration zero for analog input 5	0 to 10,000 mV
161	Calibration span for analog input 5	0 to 10,000 mV
162–169	Reserved	0

Table B-3 Configuration Table for Time-based Operation (Miscellaneous Functions)

V–Memory offsets (WY5 + *offset*)	Parameter name	Valid values
170	Interpolation master table starting address	0 to 65,000
171	Interpolation calculated table starting address	0 to 65,000
172	Interpolation table length	2, 4, 8, 16, 32, 64, 128, 256
173	Interpolation method	0: linear interpolation 1: curvelinear interpolation
174	Starting address of original table	0 to 65,000
175	Length of original table	2, 4, 8, 16, 32, 64, 128, 256
176	Starting address of expanded table	0 to 65,000
177	Length of expanded table	2, 4, 8, 16, 32, 64, 128, 256
178–179	Reserved	0

Table B-4 Configuration Table for Time-based Operation (Continuous Download Segment)

V–Memory offsets (WY5 + *offset*)	Parameter name	Valid values
180	Axis 1 hold value or die gap	0 to 32,000
181	Axis 2 hold value or die gap	0 to 32,000
182	Axis 3 hold value or die gap	0 to 32,000
183	Axis 4 hold value or die gap	0 to 32,000
184	Axis 1 manual override value (continually downloaded)	–32000 to +32000
185	Axis 2 manual override value (continually downloaded)	–32000 to +32000
186	Axis 3 manual override value (continually downloaded)	–32000 to +32000
187	Axis 4 manual override value (continually downloaded)	–32000 to +32000
188–199	Reserved	0

B.2 Configuration Tables for Position-based Operation

Table B-5 Configuration Table for Position-based Operation (Die Head)

V–Memory offsets (WY5 + *offset*)				Parameter name	Valid values
Axis 1	Axis 2	Axis 3*	Axis 4*		
0	40	80	120	Configuration word	N/A
1	41	81	121	T_s — loop sample time	1 to 32,767 milliseconds
2	42	82	122	Calibration zero for analog input	0 to 10,000 mV
3	43	83	123	Calibration span for analog input	0 to 10,000 mV
4	44	84	124	T_f — input filter time constant	0 to 32,767 milliseconds
5	45	85	125	Reserved	0
6	46	86	126	Reserved	0
7	47	87	127	K_c — proportional gain constant	0 to 327.67
8	48	88	128	T_i — integral time contant	0 to 32,767 milliseconds
9	49	89	129	T_d — derivative time constant	0 to 327.67 milliseconds
10	50	90	130	Output zero	–10,000 to +10,000 mV
11	51	91	131	Output span	–10,000 to +10,000 mV
12	52	92	132	Profile setpoint table starting address	0 to 65,000
13	53	93	133	Profile setpoint table length	2, 4, 8, 16, 32, 64, 128, 256
14	54	94	134	Process variable table starting address	0 to 65,000
15	55	95	135	Reserved	0
16	56	96	136	Purge value	0 to 32,000
17	57	97	137	Weight control	–32,000 to +32,000
18	58	98	138	Phase check location	0 to 255
19	59	99	139	Phase check setpoint	0 to 32,000
20	60	100	140	Number of steps to hold phase check	0 to 256
21	61	101	141	Reserved	0
22	62	102	142	Reserved	0
23	63	103	143	Profile time-out value	0 to 65,535 milliseconds
24	64	104	144	Profile step coincidence location	0 to 255
25	65	105	145	Number of steps to hold profile coincidence output	0 to 256
26–39	66–79	106–119	146–159	Reserved	0

* Parameters listed in this table for Axis 3 and Axis 4 are valid only when used for profile control. Table B-6 lists the valid parameters for Axis 3 and Axis 4 when they are used for accumulator ram control.

Table B-6 Configuration Table for Position-based Operation (Accumulator – Mode 3 only)

V–Memory offsets (WY5 + *offset*)				Parameter name	Valid values
Axis 1*	Axis 2*	Axis 3	Axis 4		
N/A	N/A	80	120	Configuration word	N/A
N/A	N/A	81	121	T_s — loop sample time	1 to 32,767 milliseconds
N/A	N/A	82	122	Calibration zero for analog input	0 to 10,000 mV
N/A	N/A	83	123	Calibration span for analog input	0 to 10,000 mV
N/A	N/A	84	124	T_f — input filter time constant	0 to 32,767 milliseconds
N/A	N/A	85	125	Velocity scale factor	0 to 32,000 counts/mS
N/A	N/A	86	126	Shot size	0 to 32,000
N/A	N/A	87	127	K_c — proportional gain constant	0 to 327.67
N/A	N/A	88	128	T_i — integral time contant	0 to 32,767 milliseconds
N/A	N/A	89	129	T_d — derivative time constant	0 to 327.67 milliseconds
N/A	N/A	90	130	Output zero	–10,000 to +10,000 mV
N/A	N/A	91	131	Output span	–10,000 to +10,000 mV
N/A	N/A	92	132	Velocity setpoint table starting address	0 to 65,000
N/A	N/A	93	133	Velocity setpoint table length	2, 4, 8, 16, 32, 64, 128, 256
N/A	N/A	94	134	Position table starting address	0 to 65,000
N/A	N/A	95–103	135–143	Reserved	0
N/A	N/A	104	144	Position coincidence location	0 to 32,000
N/A	N/A	105	145	Hold position coincidence on until	0 to 256
N/A	N/A	106–119	146–159	Reserved	0

* Parameters listed in this table are invalid for Axis 1 and Axis 2 for accumulator ram control. See Table B-5 .

Table B-7 Configuration Table for Position-based Operation (Auxiliary Input 5)

V–Memory offsets (WY5 + *offset*)	Parameter name	Valid values
160	Calibration zero for analog input	0 to 10,000 mV
161	Calibration span for analog input	0 to 10,000 mV
162	Shot size (Mode 4 only)	0 to 32,000
163–169	Reserved	0

Table B-8 Configuration Table for Position-based Operation (Miscellaneous Functions)

V–Memory offsets (WY5 + *offset*)	Parameter name	Valid values
170	Interpolation master table starting address	0 to 65,000
171	Interpolation calculated table starting address	0 to 65000
172	Interpolation table length	2, 4, 8, 16, 32, 64, 128, 256
173	Interpolation method	0: linear interpolation 1: curvelinear interpolation
174	Starting address of original table	0 to 65,000
175	Length of original table	2, 4, 8, 16, 32, 64, 128, 256
176	Starting address of expanded table	0 to 65,000
177	Length of expanded table	2, 4, 8, 16, 32, 64, 128, 256
178–179	Reserved	0

Table B-9 Configuration Table for Position-based Operation (Continuous Download Segment)

V–Memory offsets (WY5 + *offset*)	Parameter name	Valid values
180	Axis 1 hold value or die gap	0 to 32,000
181	Axis 2 hold value or die gap	0 to 32,000
182	Axis 3 hold value or die gap; or axis 1 position shift	0 to 32,000 (–32000 to 32000)
183	Axis 4 hold value or die gap; or axis 2 position shift	0 to 32,000 (–32000 to 32000)
184	Axis 1 manual override value	–32000 to +32000
185	Axis 2 manual override value	–32000 to +32000
186	Axis 3 manual override value	–32000 to +32000
187	Axis 4 manual override value	–32000 to +32000
188–199	Reserved	0

B.3 Parameter Descriptions for Configuration Table

Table B-10 Parameter Descriptions for Configuration Table

Parameter name	Mode*	Description
Configuration word	T, P	MSB … LSB 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 Bits 1–8 Not used. Bit 9 Setpoint ramping 0: Disable setpoint ramping 1: Enable setpoint ramping Bit 10 Bipolar/unipolar outputs 0: Unipolar outputs (0 to +32000) 1: Bipolar outputs (–32000 to +32000) Bit 11 Enable/disable broken transmitter alarm 0: Disable broken transmitter alarm and clear alarm flag 1: Enable broken transmitter alarm Bit 12 PID bias calculation method 0: Freeze bias 1: Back calculate bias (recommended) Bit 13 Differentiate process variable 0: PV = scaled analog input (x) 1: PV = $dx/dt \times [\ 32000 / (\ VSF \times T_S\ )\ ]$ Bit 14 Open/closed loop control 0: Open loop 1: Closed loop Bit 15 Direct/Reverse acting control 0: Direct acting control loop (PV increases when output increases) 1: Reverse acting control loop (PV decreases when output increases) Bit 16 Filter analog signal 0: No filtering 1: First order exponential filter
T_S — loop sample time	T, P	Specifies the sample time for the analog input and output. For closed loop operation, the module calculates the PID after every sample and updates the corresponding output. The default value is 1 millisecond.
Calibration zero for analog input	T, P	Specifies the zero analog input signal where the values 0–10000 correspond to 0–10 volts if you select the 0 to 10 volt range with the jumpers on the module board. The values 0–10000 correspond to 0–5 volts if you select the 0 to 5 volt range with the jumpers. The default value is 0.

* The Mode column lists the mode of operation for which the parameter is valid:
T = time-based operation
P = position-based operation

Table B-10 Parameter Descriptions for Configuration Table (continued)

Parameter name	Mode	Description
Calibration span for analog input	T, P	Specifies the span analog input signal where the values 0–10000 correspond to 0–10 volts if you select the 0 to 10 volt range with the jumpers on the module board. The values 0–10000 correspond to 0–5 volts if you select the 0 to 5 volt range with the jumpers. The default value is 10000.
T_f — input filter time constant	T, P	Specifies the input filter time constant for a first order filter. The module implements the first order filter with the following equations: If $K = T_s / (T_s + T_f)$, then $V_{out} = (K \times V_{in}) + [(1 - K) \times V_{out\ previous}]$
$P_{t\ initial}$ — Initial profile time	T	Specifies the profile time $P_{t\ initial}$ that the module uses when you begin running time-based profiles. When the controller downloads the Configuration Table to the module, it copies $P_{t\ initial}$ to P_t. Depending on the P_t calculation method you specify later in this table, the profile time either stays constant at $P_{t\ initial}$, changes to the last profile time measured, or changes to a value based on a average of previously measured profile times.
Velocity scale factor	P	Specifies the velocity scale factor for scaling the differentiated input signal to the 0 to 32000 range. The resulting process variable is scaled to 32000 when the maximum velocity occurs. The automatic calibration feature of the TurboParison module can determine the value of the velocity scale factor (VSF) for you. To determine the VSF on your own, use the following formula: $VSF = \dfrac{\textit{number of counts moved by ram or screw}}{\textit{time needed to move those counts (in seconds)}}$
Shot size	P	Specifies the accumulator shot size, where total stroke = 32000.
K_c — proportional gain constant	T, P	Specifies the closed loop proportional gain for PID calculations. This parameter is not used in open loop mode. Note that a value of 100 specifies $K_c = 1.00$ (i.e., there is an implied decimal point).
T_i — integral time constant	T, P	Specifies the closed loop integral time constant for PID calculations. A larger constant increases integral (reset) activity. If you leave the value of this field at zero, no integral activity occurs. This parameter is not used in open loop mode.
T_d — derivative time constant	T, P	Specifies the closed loop derivative time constant for PID calculations. For most applications, leave the value of this parameter at zero. This parameter is not used in open loop mode. Note that a value of 100 specifies $T_d = 1.00$ ms (i.e., there is an implied decimal point).
Output zero	T, P	Specifies the analog output zero signal value where the values –10000 to 10000 correspond to –10 to 10 volts if you select the –10 to 10 volt range with the jumpers on the module board. The values –10000 to 10000 correspond to –5 to 5 volts if you select the –5 to 5 volt range with the jumpers. The default value is 0.

Table B–10 Parameter Descriptions for Configuration Table (continued)

Parameter name	Mode	Description
Output span	T, P	Specifies the analog output span signal value, where the values –10000 to 10000 correspond to –10 to 10 volts if you select the –10 to 10 volt range with the jumpers on the module board. The values –10000 to 10000 correspond to –5 to 5 volts if you select the –5 to 5 volt range with the jumpers. The default value is 10000.
Profile Setpoint Table starting address	T, P	Specifies the first V-memory location of the Profile Setpoint Table. This table contains the profile step information.
Profile Setpoint Table length	T, P	Specifies the length (number of profile steps) of the Profile Setpoint Table. The last profile step resides at the location determined by the following equation: Setpoint Table pointer + (table length – 1). The default length is 256.
Velocity Setpoint Table starting address	P	Specifies the first V-memory location of the Velocity Setpoint Table. This table contains the velocity setpoint data that controls the accumulator ram or reciprocating screw. The default length is 256.
Velocity Setpoint Table length	P	Specifies the length of the Velocity Setpoint Table for position-based control. The last table entry resides at the location determined by the following equation: Velocity Setpoint Table starting address + (table length – 1).
Position Table starting address	P	Specifies the first V-memory location of the Position Table. This table contains the position information that controls transitions between velocity setpoints. This table is used in conjunction with the Velocity Setpoint Table and has the same length.
Process Variable Table starting address	T, P	Specifies the first V-memory location of the profile PV Table. This table contains the actual profile value at the end of a step. The TurboParison module uploads this table to the controller at the end of every profile. The PV Table is the same length as the Profile Setpoint Table. You must allocate enough V-memory for the PV Table so that important data is not overwritten. If you set this parameter to zero, the module does not upload the PV Table.
Sync delay (phase shift) time	T	Specifies the amount of time to shift the phase of a profile with respect to the incoming sync pulses. The default value is 0, which does not produce a phase shift.
Purge value	T, P	Specifies the purge setpoint value to which the loop controller is set when you set the purge command bit in WY8.
Weight control	T, P	Specifies the weight value that is added to all Profile Setpoint Table entries before they are fed to the loop controller. This value provides a weight offset that biases the profile either up or down.

Table B-10 Parameter Descriptions for Configuration Table (continued)

Parameter name	Mode	Description
Phase check location	T, P	Specifies the offset in the Profile Setpoint Table to start a phase check operation. (Note that this is typically the desired profile step – 1.) The phase check feature is enabled only if the phase check command bit in WY8 is set.
Phase check setpoint	T, P	Specifies the setpoint value to force the loop controller when the module reaches the phase check location in the Profile Setpoint Table. The phase check value remains forced for the number of steps specified by the next parameter.
Number of steps to hold phase check	T, P	Specifies the number of steps to hold the forced phase check value. If you set the number of steps to zero, the phase check value remains forced until the end of the profile.
Profile time calculation method	T	Specifies the calculation method, if any, to be used for profile time calculations. You can enter the value 0, 1, 2, or 3 for this parameter and these values correspond to the following calculation methods: 0: $P_t = P_{t\ initial}$ (default value) 1: $P_t = P_{t\ previous}$ (previous measured P_t is used) 2: $P_t = (P_t + P_{t\ previous}) / 2$ (running average) 3: P_t = average of the number of profiles specified by the next parameter
Number of cycles needed to average profile time	T	Specifies the number of cycles used to calculate the average profile time when you select option 3 for the profile time calculation method. This parameter is valid only if option 3 is selected.
Profile time-out value	T, P	Specifies the time-out value for a profile. If a profile does not complete before the time-out occurs, the module sets the corresponding time-out bit in WX3. The bit is not cleared until the beginning of the next cycle. If the value is zero, the module does not use a time-out (time-out = infinity).
Profile step coincidence location	T, P	Specifies the offset in the Profile Setpoint Table where the profile step coincidence output (discrete output) turns on. (Note that this is typically the desired profile step – 1.) This discrete output remains on for the number of steps specified by the parameter Number of steps to hold profile coincidence output.
Number of steps to hold profile coincidence output	T, P	Specifies the number of steps to hold on the profile coincidence output. If you enter zero for this parameter, the output remains on until the beginning of the next cycle. The default value is 0.
Position coincidence location	P Mode 3 only	Specifies the ram position where the position coincidence output (discrete output) turns on. This discrete output remains on for the number of steps specified by the parameter Hold Position Coincidence On Until.
Hold position coincidence on until	P Mode 3 only	Specifies the ram position where the position coincidence output turns off. If you enter zero for this parameter, the output remains on until the end-of-shot occurs. The default value is 0.

Table B-10 Parameter Descriptions for Configuration Table (continued)

Parameter name	Mode	Description
Interpolation master table starting address	T, P	Specifies the first V-memory location of the table that you want to interpolate.
Interpolation calculated table starting address	T, P	Specifies the first V-memory location of the resulting interpolated table.
Interpolation table length	T, P	Specifies the length (number of V-memory locations) of the resulting interpolated table.
Interpolation method	T, P	Specifies the type of interpolation to be performed on the original table. The valid values are: 0: linear interpolation 1: curvilinear interpolation
Starting address of original table	T, P	Specifies the first V-memory location of the table that you want to expand.
Length of original table	T, P	Specifies the length (number of V-memory locations) of the table that you want to expand.
Starting address of expanded table	T, P	Specifies the first V-memory location of the expanded table.
Length of expanded table	T, P	Specifies the length (number of V-memory locations) of the expanded table.
Axis *x* hold value or die gap *x* = 1, 2, 3, or 4	T, P	Specifies the setpoint to which the axis controller returns when profile execution is disabled. Note that these hold values are continually downloaded to the module (usually once every controller scan).
Axis *x* manual override value *x* = 1, 2, 3, or 4	T, P	Specifies the value of the output when manual override is enabled. This overrides all other settings for each axis. These values are continually downloaded.

Appendix C
General Status Table Data

C.1 General Status Table Contents

Table C-1 General Status Table Contents

V-memory offsets (WY5 + *offset*)	Parameter Description
200	Current analog input from axis 1
201	Current analog input from axis 2
202	Current analog input from axis 3
203	Current analog input from axis 4
204	Current analog input from auxiliary input 5
205	Current PV from axis 1
206	Current PV from axis 2
207	Current PV from axis 3
208	Current PV from axis 4
209	Reserved
210	Current output for axis 1
211	Current output for axis 2
212	Current output for axis 3
213	Current output for axis 4
214	Current discrete inputs and outputs — Indicates the status of the discrete inputs and outputs. The word contained in this V-memory location has the following breakdown: MSB … LSB 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 **Bits 1–4** Dipswitch settings: these bits may be used by the RLL to verify the dipswitch was set correctly. 0000 Mode 1 0001 Mode 2 0010 Mode 3 0011 Mode 4 0100 Mode 5 **Bit 5** At shot size for profile 2 **Bit 6** At end of shot for profile 2 **Bit 7** At shot size for profile 1 **Bit 8** At end of shot for profile 1 **Bits 9–12** Output on for following axes: Bit 9 corresponds to axis 4 Bit 10 corresponds to axis 3 Bit 11 corresponds to axis 2 Bit 12 corresponds to axis 1 **Bit 13–16** Input on for following axes: Bit 13 corresponds to axis 4 Bit 14 corresponds to axis 3 Bit 15 corresponds to axis 2 Bit 16 corresponds to axis 1

Table C-1 General Status Table Contents (continued)

V-memory offsets (WY5 + *offset*)	Parameter Description
215	Broken transmitter alarm — Indicates whether a broken transmitter alarm is on for one or more of the axes. Bits 1 through 12 are not used. Bit 13 corresponds to axis 4 Bit 14 corresponds to axis 3 Bit 15 corresponds to axis 2 Bit 16 corresponds to axis 1
216	Last profile time for axis 1
217	Last profile time for axis 2
218	Last profile time for axis 3
219	Last profile time for axis 4
220	$P_{t\ calculated}$ for axis 1 (time-based operation only)
221	$P_{t\ calculated}$ for axis 2 (time-based operation only)
222	$P_{t\ calculated}$ for axis 3 (time-based operation only)
223	$P_{t\ calculated}$ for axis 4 (time-based operation only)
224	Weight correction for profile A
225	Weight correction for profile B
226	Weight correction for profile C
227	Weight correction for profile D
228	Current setpoint for axis 1
229	Current setpoint for axis 2
230	Current setpoint for axis 3
231	Current setpoint for axis 4
232 – 299	Reserved

Appendix D
Specifications

D.1 Physical and Environmental Specifications

Table D-1 Physical and Environmental Specifications

Minimum torque for bezel screws	2.6 in-lb (0.3N-m)
Maximum torque for bezel screws	4.12 in-lb (0.6N-m)
Input signal wiring	Shielded, twisted pair cable (12–26 AWG or 0.16–3.2 mm^2, stranded or solid)
Spade lug for use with connector PPX:2587705–8002	Amp part number 321462
Ring lug for use with connector PPX:2587705–8002	Amp part number 327891
Module power required from base	7 W of +5 V; no –5 V
Operating temperature	0 to 60°C (32 to 140°F)
Storage temperature	–40 to +70°C (–40 to 158°F)
Relative humidity	5% to 95% noncondensing
Pollution degree	2, IEC 664, 664 A
Vibration	Sinusoidal IEC 68-2-6, Test Fc 0.15 mm peak-to-peak, 10–57 Hz; 1.0 g, 57–150 Hz Random IEC 68-2-34, Test Fdc, equivalent to NAVMAT P–9492 0.04 g^2/Hz, 80–350 Hz
Electrostatic discharge	IEC 801, Part 2, Level 4, (15 kV)
Shock	IEC 68-2-27; Test Ea
Noise immunity, conducted	IEC 801, Part 4, Level 3
Noise immunity, radiated	IEC 801, Part 3, Level 3, MIL STD 461B RS01, and RS02
Isolation, inputs to controller	1500 Vrms
Corrosion protection	All parts of corrosion-resistant material or plated or painted as corrosion protection
Agency approvals	U.L. listed (UL508), CSA certified (C22.2 No. 192), FM approved for Class I, Div. 2 Hazardous Locations

D.2 Analog Performance Specifications

Table D-2 High-Speed Analog Outputs

Item	Value
Voltage ranges	0 to +10 V or 0 to –10 V; 0 to +5 V or 0 to –5 V
Resolution	12-bit, 0.25% accuracy
Current	5 mA output current

Table D-3 High-Speed Analog Inputs

Item	Value
Voltage range	0 to +10 V 0 to +5 V
Resolution	12-bit, 0.1% accuracy
Common mode input range	± 25 VDC, ACpk
Common mode input rejection	60 db @ 60 Hz
Common mode input impedence	400 k Ω typical
Differential input impedence	800 k Ω typical

D.3 Discrete Output and Input Specifications

Table D-4 Discrete Output Specifications

Item	Value
Total output current (all outputs on)	0.90 A (40°C) 0.75 A (60°C)
Maximum current per output	0.50 A (40°C) 0.40 A (60°C)
Rated voltage	15 to 24 VDC
Operating voltage range	12 to 30 VDC
Temporary overload	2.0 A for 1 ms
Maximum on-state voltage drop	0.5 VDC
Maximum off-state leakage current	0.2 mA
Kickback protection	diode
Maximum delay time through module (with 5 ma minimum load)	1 ms on to off; 1 ms off to on
Type of outputs	non-latching, unprotected
Output fuse rating	1 amp, 125 V, normal blow, 5x20 mm

Table D-5 Discrete Input Specifications

Item	Value
Rated voltage	24 VDC
Input voltage range for ON	14.0 VDC minimum 30.0 VDC maximum
Input voltage range for OFF	0.0 VDC minimum 5.0 VDC maximum
Input current limits during ON	2.0 mA minimum 15.0 mA maximum
Maximum input current for OFF	0.5 mA
Delay time through module	.3 ms minimum 1 ms maximum

Appendix E
Table Configuration Worksheets

The worksheets in this appendix help you configure your TurboParison module and enable you to keep a written record of the configuration. The worksheets are arranged in the following categories:

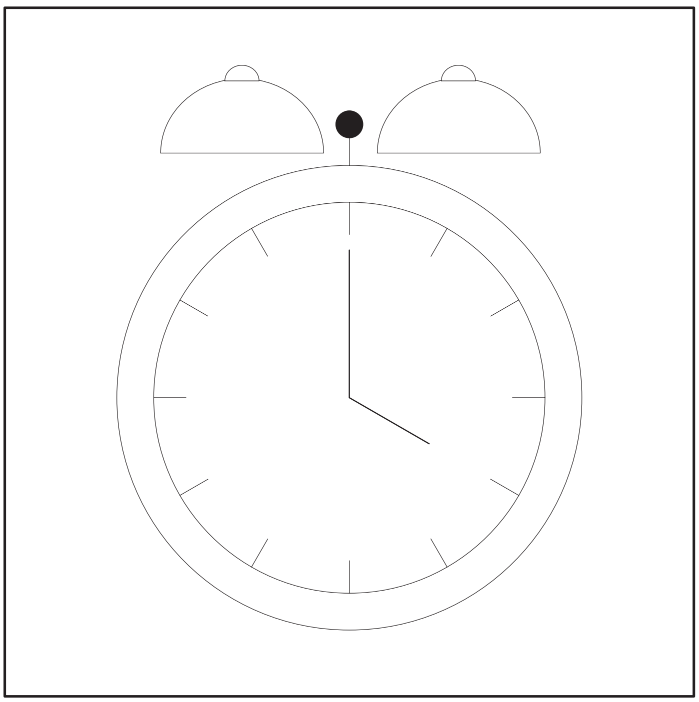
Worksheets for Time-based Operation — Use these worksheets to help you configure your module for a time-based parison process. With these worksheets you can record data for the Configuration Table and Profile Setpoint Table.

Worksheets for Position-based Operation — Use these worksheets to help you configure your module for a position-based parison process. With these worksheets you can record data for the Configuration Table, Profile Setpoint Table, Position Table, and Velocity Setpoint Table.

Worksheets for Module-related Notes — Use these worksheets to record additional information about your TurboParison Module. This section includes a worksheet for recording V-memory allocation data and a sheet for recording terminal block information.

NOTE: Make copies of the worksheets before writing configuration data in them. This will ensure that you always have clean worksheets for new configuration data.

Worksheets for Time-based Operation



Configuration Table Worksheet
Time-based Operation

V-memory start address (WY5) = _______

Note: In this table, V-memory address = *start address* + *offset*

For example, if: *start address* = V100
offset = 4

Then: V-memory address = V100 + 4 = V104

Parameter description	Axis 1			Axis 2		
	Offset	**V-memory address**	**Value entered**	**Offset**	**V-memory address**	**Value entered**
Configuration word	0			40		
T_s — loop sample time	1			41		
Calibration zero for analog input	2			42		
Calibration span for analog input	3			43		
T_f — input filter time constant	4			44		
Reserved	5			45		
$P_{t\ initial}$ — Initial profile time	6			46		
K_c — proportional gain constant	7			47		
T_i — integral time constant	8			48		
T_d — derivative time constant	9			49		
Output zero	10			50		
Output span	11			51		
Profile setpoint table starting address	12			52		
Profile setpoint table length	13			53		
Process variable table starting address	14			54		
Sync delay (phase shift) time	15			55		
Purge value	16			56		
Weight control	17			57		
Phase check location	18			58		
Phase check setpoint	19			59		
Number of steps to hold phase check	20			60		
Profile time calculation method	21			61		
Number of cycles to needed average profile time	22			62		
Profile time-out value	23			63		
Profile step coincidence location	24			64		
Number of steps to hold profile coincidence output	25			65		
Reserved	26–39			66–79		

Configuration Table Worksheet
Time-based Operation

V-memory start address (WY5) = _______

Note: In this table, V-memory address = *start address* + *offset*

For example, if: *start address* = V100
offset = 4

Then: V-memory address = V100 + 4 = V104

Parameter description	Axis 3*			Axis 4*		
	Offset	V-memory address	Value entered	Offset	V-memory address	Value entered
Configuration word	80			120		
T_s — loop sample time	81			121		
Calibration zero for analog input	82			122		
Calibration span for analog input	83			123		
T_f — input filter time constant	84			124		
Reserved	85			125		
$P_{t\ initial}$ — Initial profile time	86			126		
K_c — proportional gain constant	87			127		
T_i — integral time constant	88			128		
T_d — derivative time constant	89			129		
Output zero	90			130		
Output span	91			131		
Profile setpoint table starting address	92			132		
Profile setpoint table length	93			133		
Process variable table starting address	94			134		
Sync delay (phase shift) time	95			135		
Purge value	96			136		
Weight control	97			137		
Phase check location	98			138		
Phase check value setpoint	99			139		
Number of steps to hold phase check	100			140		
Profile time calculation method	101			141		
Number of cycles to needed average profile time	102			142		
Profile time-out value	103			143		
Profile step coincidence location	104			144		
Number of steps to hold profile coincidence output	105			145		
Reserved	106–119			146–159		

* Parameters listed in this table for Axis 3 and Axis 4 are valid for profile control only.

Configuration Table Worksheet Time-based Operation

V-memory start address (WY5) = _______

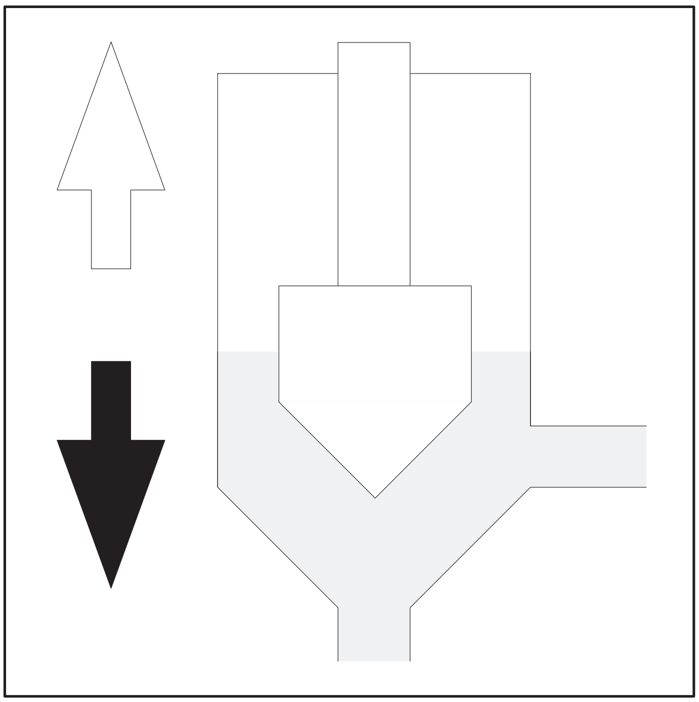
Note: In this table, V-memory address = *start address* + *offset*

For example, if: *start address* = V100
offset = 4

Then: V-memory address = V100 + 4 = V104

Parameter description	Offset	V-memory address	Value entered
Calibration zero for analog input 5	160		
Calibration span for analog input 5	161		
Reserved	162–169		
Interpolation master table starting address	170		
Interpolation calculated table starting address	171		
Interpolation table length	172		
Interpolation method	173		
Starting address of original table	174		
Length of original table	175		
Starting address of expanded table	176		
Length of expanded table	177		
Reserved	178–179		
Axis 1 hold value or die gap (continuously downloaded)	180		
Axis 2 hold value or die gap (continuously downloaded)	181		
Axis 3 hold value or die gap (continuously downloaded)	182		
Axis 4 hold value or die gap (continuously downloaded)	183		
Axis 1 manual override value (continually downloaded)	184		
Axis 2 manual override value (continually downloaded)	185		
Axis 3 manual override value (continually downloaded)	186		
Axis 4 manual override value (continually downloaded)	187		
Reserved	188–199		

Worksheets for Position-based Operation



Configuration Table Worksheet
Position-based Operation (Modes 3 and 4)

V-memory start address (WY5) = _______

Note: In this table, V-memory address = *start address* + *offset*

For example, if: *start address* = V100
offset = 4

Then: V-memory address = V100 + 4 = V104

Parameter description	Axis 1			Axis 2		
	Offset	**V-memory address**	**Value entered**	**Offset**	**V-memory address**	**Value entered**
Configuration word	0			40		
T_s — loop sample time	1			41		
Calibration zero for analog input	2			42		
Calibration span for analog input	3			43		
T_f — input filter time constant	4			44		
Reserved	5			45		
Reserved	6			46		
K_c — proportional gain constant	7			47		
T_i — integral time constant	8			48		
T_d — derivative time constant	9			49		
Output zero	10			50		
Output span	11			51		
Profile setpoint table starting address	12			52		
Profile setpoint table length	13			53		
Process variable table starting address	14			54		
Reserved	15			55		
Purge value	16			56		
Weight control	17			57		
Phase check location	18			58		
Phase check setpoint	19			59		
Number of steps to hold phase check	20			60		
Reserved	21			61		
Reserved	22			62		
Profile time-out value	23			63		
Profile step coincidence location	24			64		
Number of steps to hold profile coincidence output	25			65		
Reserved	26–39			66–79		

V-memory start address (WY5) = _______

Note: In this table, V-memory address = *start address* + *offset*

For example, if: *start address* = V100
offset = 4

Then: V-memory address = V100 + 4 = V104

Parameter description	Axis 3 (profile control only)			Axis 4 (profile control only)		
	Offset	V-memory address	Value entered	Offset	V-memory address	Value entered
Configuration word	80			120		
T_s — loop sample time	81			121		
Calibration zero for analog input	82			122		
Calibration span for analog input	83			123		
T_f — input filter time constant	84			124		
Reserved	85			125		
Reserved	86			126		
K_c — proportional gain constant	87			127		
T_i — integral time constant	88			128		
T_d — derivative time constant	89			129		
Output zero	90			130		
Output span	91			131		
Profile setpoint table starting address	92			132		
Profile setpoint table length	93			133		
Process variable table starting address	94			134		
Reserved	95			135		
Purge value	96			136		
Weight control	97			137		
Phase check location	98			138		
Phase check setpoint	99			139		
Number of steps to hold phase check	100			140		
Reserved	101			141		
Reserved	102			142		
Profile time-out value	103			143		
Profile step coincidence location	104			144		
Number of steps to hold profile coincidence output	105			145		
Reserved	106–119			146–159		

Configuration Table Worksheet
Position-based Operation (Mode 3 Only)

V-memory start address (WY5) = _______

Note: In this table, V-memory address = *start address* + *offset*

For example, if: *start address* = V100
offset = 4

Then: V-memory address = V100 + 4 = V104

Parameter description	Axis 3 (accumulator control only)			Axis 4 (accumulator control only)		
	Offset	V-memory address	Value entered	Offset	V-memory address	Value entered
Configuration word	80			120		
T_s — loop sample time	81			121		
Calibration zero for analog input	82			122		
Calibration span for analog input	83			123		
T_f — input filter time constant	84			124		
Velocity scale factor	85			125		
Shot size	86			126		
K_c — proportional gain constant	87			127		
T_i — integral time constant	88			128		
T_d — derivative time constant	89			129		
Output zero	90			130		
Output span	91			131		
Velocity setpoint table starting address	92			132		
Velocity setpoint table length	93			133		
Position table starting address	94			134		
Reserved	95–103			135–143		
Position coincidence location	104			144		
Hold position coincidence on until	105			145		
Reserved	106–119			146–159		

V-memory start address (WY5) = _______

Note: In this table, V-memory address = *start address* + *offset*

For example, if: *start address* = V100
offset = 4

Then: V-memory address = V100 + 4 = V104

Parameter description	Offset	V-memory address	Value entered
Calibration zero for analog input 5	160		
Calibration span for analog input 5	161		
Shot size	162*		
Reserved	163–169		
Interpolation master table starting address	170		
Interpolation calculated table starting address	171		
Interpolation table length	172		
Interpolation method	173		
Starting address of original table	174		
Length of original table	175		
Starting address of expanded table	176		
Length of expanded table	177		
Reserved	178–179		
Axis 1 hold value or die gap (continuously downloaded)	180		
Axis 2 hold value or die gap (continuously downloaded)	181		
Axis 3 hold value or die gap (continuously downloaded)	182		
Axis 4 hold value or die gap (continuously downloaded)	183		
Axis 1 manual override value (continually downloaded)	184		
Axis 2 manual override value (continually downloaded)	185		
Axis 3 manual override value (continually downloaded)	186		
Axis 4 manual override value (continually downloaded)	187		
Reserved	184–199		

* Mode 4 only,

Configuration Table Worksheet Position-based Operation (Mode 5 Only)

V-memory start address (WY5) = _______

Note: In this table, V-memory address = *start address* + *offset*

For example, if: *start address* = V100
offset = 4

Then: V-memory address = V100 + 4 = V104

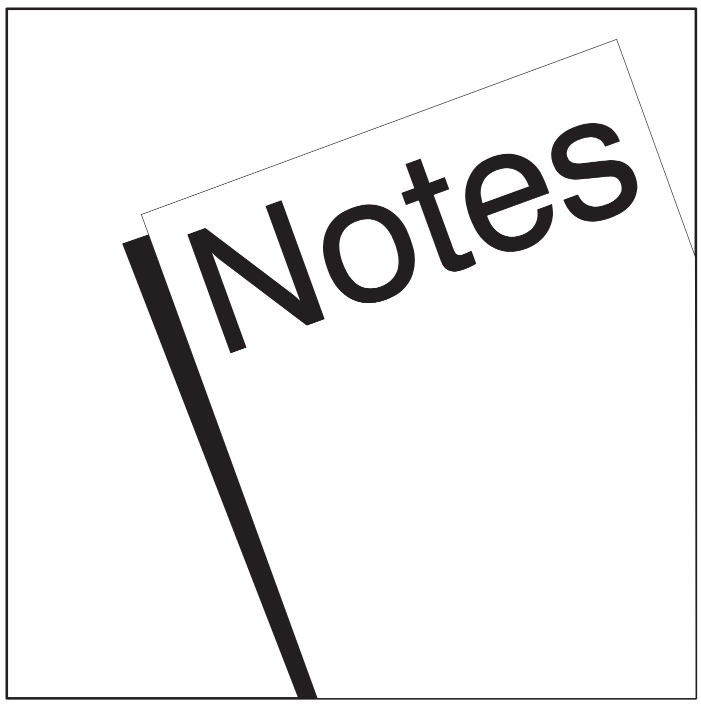
Parameter description	Axis 1 (accumulator control only)			Axis 2 (accumulator control only)		
	Offset	V-memory address	Value entered	Offset	V-memory address	Value entered
Configuration word	0			40		
T_s — loop sample time	1			41		
Calibration zero for analog input	2			42		
Calibration span for analog input	3			43		
T_f — input filter time constant	4			44		
Reserved	5			45		
Reserved	6			46		
K_c — proportional gain constant	7			47		
T_i — integral time constant	8			48		
T_d — derivative time constant	9			49		
Output zero	10			50		
Output span	11			51		
Profile setpoint table starting address	12			52		
Profile setpoint table length	13			53		
Process variable table starting address	14			54		
Reserved	15			55		
Purge value	16			56		
Weight control	17			57		
Phase check location	18			58		
Phase check setpoint	19			59		
Number of steps to hold phase check	20			60		
Reserved	21			61		
Reserved	22			62		
Profile time-out value	23			63		
Profile step coincedencee locatiion	24			64		
Number of steps to hold profile coincidence output	25			65		
Reserved	26–39			66–79		
Reserved	80–159					

V-memory start address (WY5) = _______

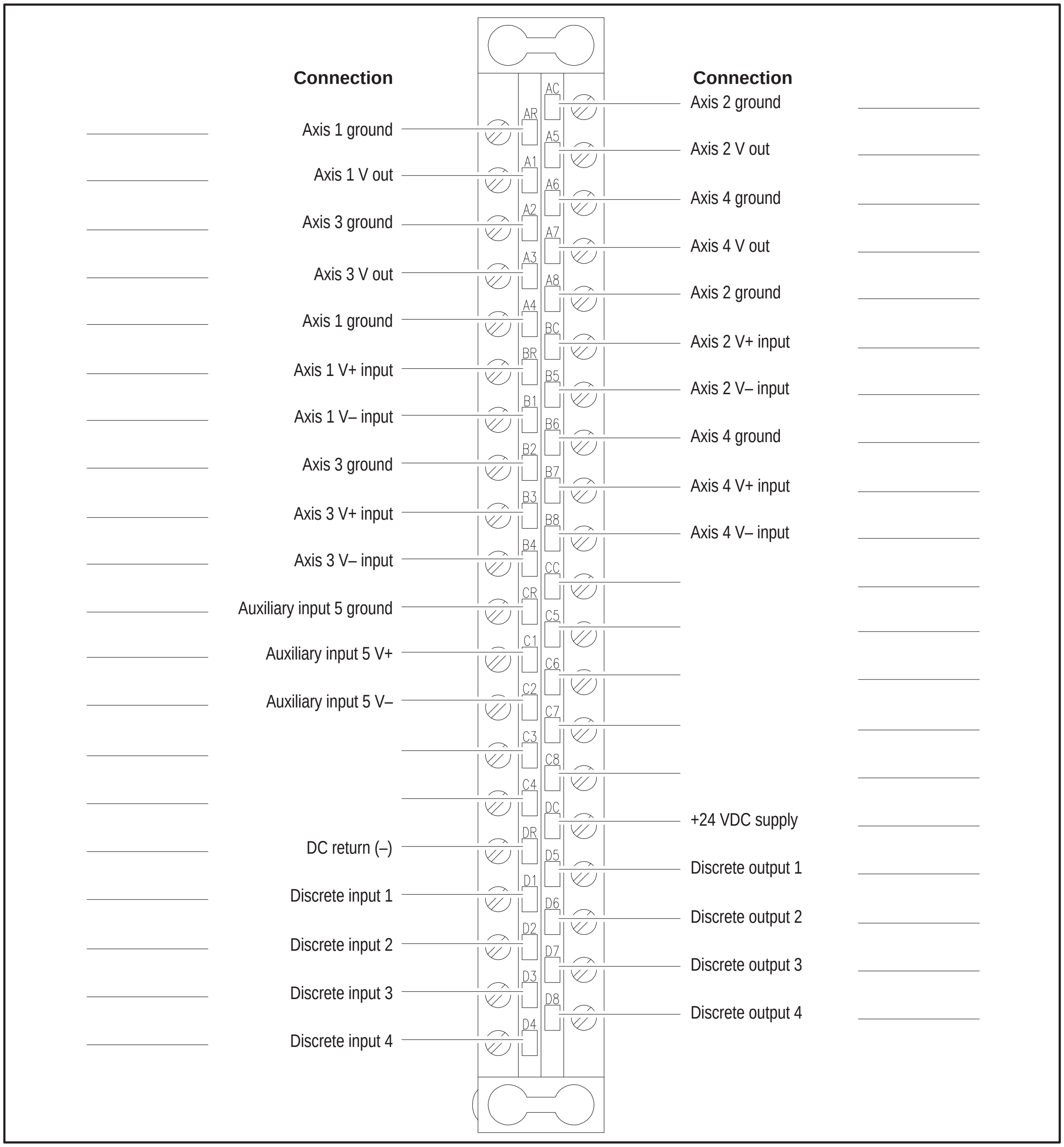
> **Note:** In this table, V-memory address = *start address* + *offset*
>
> For example, if: *start address* = V100
> *offset* = 4
>
> Then: V-memory address = V100 + 4 = V104

Parameter description	Offset	V-memory address	Value entered
Calibration zero for analog input 5	160		
Calibration span for analog input 5	161		
Reserved	162–169		
Interpolation master table starting address	170		
Interpolation calculated table starting address	171		
Interpolation table length	172		
Interpolation method	173		
Starting address of original table	174		
Length of original table	175		
Starting address of expanded table	176		
Length of expanded table	177		
Reserved	178–179		
The following values are continuously downloaded to module.			
Axis 1 hold value or die gap	180		
Axis 2 hold value or die gap	181		
Axis 1 parison position shift	182		
Axis 2 parison position shift	183		
Axis 1 manual override value	184		
Axis 2 manual override value	185		
Axis 3 manual override value	186		
Axis 4 manual override value	187		
Reserved	188–199		

Worksheets for Module-related Notes



Terminal Block Connections Worksheet
Module-related Notes



V-memory Allocation Worksheet
Module-related Notes

Permanent Memory Addresss

Table name		V-memory addresses		Memory reserved
		Start	End	
Configuration Table				
General Status Table				
Axis 1	Profile Setpoint Table			
	Process Variable Table			
Axis 2	Profile Setpoint Table			
	Process Variable Table			
Axis 3	Profile Setpoint Table			
	Process Variable Table			
	Velocity Setpoint Table (position mode only)			
	Position Table (position mode only)			
Axis 4	Profile Setpoint Table			
	Process Variable Table			
	Velocity Setpoint Table (position mode only)			
	Position Table (position mode only)			
Total number of V-memory addresses reserved ⇒				

Temporary Memory Addresss

Table name	V-memory addresses		Memory reserved
	Start	End	
Interpolation Master Table			
Interpolation Calculated Table			
Original Table			
Expanded Table			
Total number of V-memory addresses reserved ⇒			

Index

A

B

C

D

O

P

R

S

T

U

Customer Response

We would like to know what you think about our user manuals so that we can serve you better. How would you rate the quality of our manuals?

	Excellent	Good	Fair	Poor
Accuracy	_______	_______	_______	_______
Organization	_______	_______	_______	_______
Clarity	_______	_______	_______	_______
Completeness	_______	_______	_______	_______
Graphics	_______	_______	_______	_______
Examples	_______	_______	_______	_______
Overall design	_______	_______	_______	_______
Size	_______	_______	_______	_______
Index	_______	_______	_______	_______

Would you be interested in giving us more detailed comments about our manuals?

☐ **Yes!** Please send me a questionnaire.

☐ **No.** Thanks anyway.

Your Name: ____

Title: ____

Telephone Number: (_____) ______________________________________

Company Name: ____

Company Address: ____

____

____

Manual Name: SIMATIC 505 TurboParison Module User Manual **Edition:** Third

Manual Assembly Number: 2586546–0069 **Date:** 06/95

Order Number: PPX:505–8118–3

FOLD

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO.3 JOHNSON CITY, TN

POSTAGE WILL BE PAID BY ADDRESSEE

ATTN: Technical Communications M/S 519
SIEMENS INDUSTRIAL AUTOMATION INC.
3000 BILL GARLAND RD
P O BOX 1255
JOHNSON CITY TN 37605–1255

FOLD