

APPLICATION NOTE

TITI E.	Setup of Digispense® 4000 with PLCs and	AN-101
	Gateways	REV B
CATEGORY:	Controller Interface	

1. DESCRIPTION

This application note describes how to setup an IVEK Digispense® 4000 (DS4000) for use with PLCs and Gateways. Presently, EtherNet/IP[™], PROFINET® and EtherCAT®¹ are the communication interfaces available on the DS4000PM controller. The DS4000BT controller has an HMI and discrete I/O in addition to optional interfaces (e.g., EtherNet/IP, PROFINET, EtherCAT, RS232, etc.). Controllers containing an ethernet-based interface module also contain an HTTP server and an FTP server.

Configuring the DS4000 for an application requires modifying parameters to match the physical system (pump motor type, pump size, etc.) and to create the desired fluidic movement profile (acceleration, discharge rate, etc.). Controlling the DS4000 also requires reading and writing parameters (e.g., to start operations, check status, etc.). The DS4000 has over 200 parameters, many of these require no modification (i.e., the default values are sufficient). Also, the DS4000 has non-volatile memory so changes to most parameters will remain across a power-cycle.

NOTE: Ivek uses the word "parameter(s)" for the data inside of the DS4000 that may be exchanged with other devices such as PLCs and PCs. Some PLC and fieldbus literature also refer to their own parameters. It is important to note that in this document "parameter(s)" almost always refers to a DS4000 parameter. All parameters are listed in the product manual.

There are several ways to modify parameters. On a DS4000BT, the simplest way is by using the HMI; on a DS4000PM, by using the web pages or fieldbus. When using a fieldbus, such as: EtherNet/IP, PROFINET, or EtherCAT; accessing the parameters is accomplished via cyclic (implicit) data exchange or acyclic (explicit) data exchange (e.g. MSG functions). Some PLC development systems provide an extra mechanism to modify parameters (e.g., the Parameter Tab of the Module Properties window in Studio 5000®). Not all parameters are available via cyclic data exchange; only those parameters that are important for real-time control (e.g., commands and status).

There are trade-offs in choosing which method to use to modify parameters. The simpler methods (e.g., HMI, web pages) reduce development time, but make device replacement more difficult due to the need to manually configure a replacement controller. The more complex methods (e.g., acyclic exchange, MSG functions), require extra development time, but allow the PLC software to verify that parameters are configured to desired values before initiating pumping operations. Often, the simpler methods are used during the beginning stages of a project as the fluidic parameters are being determined and as the PLC engineer is getting familiar with the controller. The more complex methods are then employed as the PLC application matures and verification of parameters is desired.

¹ EtherCAT® is a registered trademark and patented technology, license by Beckhoff Automation GmbH, Germany.

2. ACCESSING THE DS4000 USING ROCKWELL STUDIO 5000

Studio 5000 is the development environment for Rockwell PLCs. Accessing the DS4000 requires installing it's EDS file into Studio 5000. The EDS file provides information for Studio 5000 to automatically create Module Defined Data Types and Controller Tags upon addition of a DS4000 to a project. *This reduces the need to create custom User Defined Data Types (UDTs), Add-on Profiles (AOPs), and Tags for programming with the DS4000*.

The following instructions describe how to install the DS4000 in a Studio 5000 project and how to modify parameters via the Parameters tab, the MSG block and the Cyclical I/O Controller Tags. These instructions were generated using an Allen-Bradley CompactLogixTM 5380 (5069-L306ER), an IVEK Digispense 4000, and Rockwell Automation Studio 5000 Logix Designer (version 34.01.00). **NOTE: the Customer Example was developed using DS4000PM v2.3.** A newer version of DS4000PM or a DS4000BT may be used by updating/installing the proper EDS file.

2.1. Adding the EDS File

The EDS file and icon (lvek.ico) for the DS4000 must be imported into Studio 5000 using the EDS import wizard. If upgrading the EDS file from a previous version, the previous version must first be uninstalled (see section 2.2).

The EDS file is located on the file system of the DS4000 (a zipped file contains the EDS files and the IVEK icon file). A hyperlink to the file exists on the DS4000's web pages (Help->Manuals). Alternatively, FTP may be used to access the file (see section 5.3). The latest EDS file is also located on the IVEK website (<u>https://www.ivek.com/manuals.html</u>).

Firmware Version	EDS File
560010-0101	05F1002B00010103.eds, v1.03
560010-0102	05F1002B00010103.eds, v1.03
560010-0201	05F1002B00010201.eds, v2.01
560010-0202	05F1002B00010202.eds, v2.02
560010-0203	05F1002B00010203.eds, v2.03 (DS4000PM) or 05F1002B00030203.eds, v2.03 (DS4000BT)
560010-0204	05F1002B00010204.eds, v2.04 (DS4000PM) or 05F1002B00030204.eds, v2.04 (DS4000BT)

Make sure the installed EDS is the correct version for the specific DS4000 firmware version.

Note: if the DS4000 is in Bootloader mode, the DS4000 appears as a different device. Also, it is not certified as an EtherNet/IP device in this mode, so removal from an existing EtherNet/IP network is recommended. The EDS file, 05F1002B00040102.eds, is provided in case the PLC needs to connect to the DS4000 in bootloader mode. However, connection by a PLC is not necessary in order to access web pages and perform FTP transfers.

Instruction	Image
Start the EDS Wizard. Press the Next button.	Rockwell Automation's EDS Wizard X Welcome to Rockwell Automation's EDS Wizard The EDS Wizard allows you to: -register EDS-based devices. - urregister a device. - change the graphic images associated with a device. - create an EDS file from an unknown device. - upload EDS file(s) stored in a device. To continue click Next
Select "Register an EDS file(s)" and press the Next button.	Rockwell Automation's EDS Wizard × Options What task do you want to complete? Image: Complete (State (S

Select "Register a single file" and browse for the EDS file. Press the Next button to start installation of the EDS file.	Rockwell Automation's EDS Wizard × Registration Bectronic Data Sheet file(s) will be added to your system for use in Rockwell Automation applications. • Register a gingle file • Chemp Siver States • Encode States
	• If there is an icon file (ico) with the same name as the file(s) you are registering then this image will be associated with the device. To perform an installation test on the file(s), click Next
	< <u>Back</u> Next > Cancel
Verify that the EDS file was successfully installed. Press the Next button.	Rockwell Automation's EDS Wizard X EDS File Installation Test Results This test evaluates each EDS file for errors in the EDS file. This test does not guarantee EDS file validity. Image: Installation Test Results Image: Imstallation Test Results Image: Imstallation Test Results Image: I
	Vew file

Verify that the IVEK icon is shown and then press the Next button.	Rockwell Automation's EDS Wizard × Change Graphic Image Image You can change the graphic image that is associated with a device. Image Product Types Image icon Change icon Image Vendor Specific Type Image icon Image icon
	<back cancel<="" td=""></back>
Verify that the DS4000 is the device to register and press the Next button to register the device.	Rockwell Automation's EDS Wizard X Final Task Summary Image: Complete



2.2. Removing an EDS file (for upgrading purposes)

When upgrading an EDS file, it is best to first remove the previous EDS file from Studio 5000 using the EDS Wizard. After removing the previous version of the EDS file using the instructions listed below, install the new version using the instructions per section 2.1.

Instruction	Image
Start the EDS Wizard. Select "Unregister a device" and press the Next button.	Rockwell Automation's EDS Wizard × Options What task do you want to complete? Image: Complete (Complete) Image: Complete (Complete) Image: Complete (Complete) Image: Complete (Complete) Complete) Image: Complete) Complete) Image: Complete) Complete) Image: Complete) Complete) Image: Complete) Complete) <td< td=""></td<>
	< Back Next > Cancel





2.3. Adding the DS4000 to a Project

After installing the EDS file of the DS4000 using the EDS Wizard, the DS4000 is available for addition to a project in Studio 5000. The following instructions show how to add a DS4000.



Select "DS4000PM" or "DS4000BT" from the catalog and press the Create button. The Module Properties window should open automatically.	Select Module Type Catalog Module Discovery DS Module Type Cate 20 - Comm-ER Analog CIP Motion Safety T Communication	Favorites	Clear Filters Module Type Vendor Fil Advanced Energy Indus Bray International, Inc Buerkert Fluid Control Sy Dialight	Hide Filten tres tries, Inc. rstems	s *
	Catalog Number De DS4000 DS DS4000BT DS DS4000PM DS 3 of 739 Module Types Fo	scription Vendor 4000 Bootloa IVEK Corporation 1VEK Corporation 4000PM IVEK Corporation 4000PM VEK Corporation	Category Generic Device Generic Device Generic Device	Agd to Fav Create Close	vorites
Select the General tab	Rew Module	_			×
and provide a Name	General* Connection	General			
Configure the	- Parameters	Type: DS4000PM DS40 Vendor: IVEK Corporation	000PM		
Ethernet address for	Port Configuration Network	Parent: Local		Ethernet Address	
the device.		Description:		O Private Network: 1	92.168.1. 1
				O IP Address:	5 V 5
NOTE: the DS4000 is				⊖ <u>H</u> ost Name:	
configured from the		Madula Definition	Ψ		
DHCP enabled so		Revision:	2.003		
you may need to use		Electronic Keying: Connections:	Compatible Module Exclusive owner		
IPConfig (see					
section 5.1) to			Change		
disable DHCP and	Status: Constinue				
configure a static IP	status, uroduny				Саниен
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Select the Connection tab and verify the	New Module General* Gonnection Module Info	Connection			×
settings for the	Parameters Internet Protocol Port Configuration Network	Name	Requested Packet Interval (RPI) (ms)	Connection over EtherNet/IP	Input Trigger
Press the OK button		Exclusive owner	10.0 🔷 1.0 - 3200.0	Unicast 🗸	Cyclic 🗸
then press the Close button on the Select Module Type window. Verify the DS4000 module appears in the project.	Status: Creating	Inhibit Module Major Fault On Controller If Connection Fault Module Fault	ails While in Run Mode	ОК	Cancel Help

2.4. Using Cyclical I/O Controller Tags

Controller Tags and Module-Defined Data Types for the I/O data are automatically created when the DS4000 is added to the project (i.e., it is not necessary to manually map the number of bytes to exchange – though that information is contained in section 6). The Controller Tags contain several parameters that are useful for real-time control of the pumping operations. There are Tags available in the Input direction, and separate Tags available in the Output direction. Detailed information about each of the parameters contained in the I/O Controller Tags is available in the DS4000 product manual.

Not all parameters are available as I/O Controller Tags, only the subset necessary for real-time control of the pumping operations. The Cyclical I/O Controller Tags are exchanged between the PLC and the DS4000 using implicit messages on the EtherNet/IP network.

Logix Designer - TestPLC in CustomerExample_v2_3.ACD (5069-L306	R 34.11]						- 🗆 ×
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85 CHANNEL_AI_HART:1:0	Name: _05F1:D54000	PIM_EABB3C00:0:0			Data Type Size: 20 bytes	Extended Properti	es *
器 CHANNEL_AO:0:0	Description:					▲ General	
Bi CHANNEL_AO_DIAG:I:0						Data Type Size	20 bytes
85 CHANNEL_AO_DIAG_CAL:1:0	Members:					Description	200
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CHANNEL_DI_TIMESTAMP:I:0	MotionEnable	ROOL					
器 CHANNEL_DI_IIMESIAMP:0:0 器 CHANNEL DO:I:0	StopAll	BOOL					
85 CHANNEL_DO:0:0	StartProduction	BOOL					
Sti CHANNEL_DO_DIAG:I:0	StartFluidic	BOOL					
器 CHANNEL_DO_OVERRIDE:0:0	StartReference	BOOL					
器 CHANNEL_HSC:I:0	ClearFault	BOOL					
811 CHANNEL_HSC:0:0	ClearAlert	BOOL					
81 05F1:DS4000PM 3107E267:I:0	StartLoad	BOOL					
88 _05F1:DS4000PM_EABB3C06:0:0	CrossoverSynchrono	us BOOL					
Trends	ParkPort	BOOL					
▲ SilvO Configuration	UnparkPort	BOOL					
🖌 🚍 5069 Backplane	StartUnstick	BOOL					
[0] 5069-L306ER TestPLC	TestTorque	BOOL					
5069-L306ER TestPLC	TriggerRequired	BOOL					
New DS4000PM DS4000_1	GateProdStartStop	BOOL					
In Controller Organizer			OK	Cancel	Apply Help		
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Figure 1, Module-Defined Data Type created automatically when EDS installed (Output)

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an CHANNEL AO CALO	Description:				▲ General	
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器 CHANNEL_AO_DIAG_CAL:I:0	Members:				Description	
81 CHANNEL_DI:I:0	Name	Data Type	Description		Name	_05F1:DS4000PM_3
B CHANNEL DI COUNTER:0	ConnectionFaulted	BOOL		A		
a CHANNEL DI TIMESTAMP:I:0	StatusFlags	DINT				
CHANNEL_DI_TIMESTAMP:0:0	Initialized	BOOL				
ISS CHANNEL_DO:I:0	Configured	BOOL				
器 CHANNEL_DO:0:0	Faulted	ROOL				
CHANNEL DO OVERRIDE:0:0	AL	BOOL				
IN CHANNEL DO SCHEDULED:0:0	Alerted	BOOL				
IN CHANNEL_HSC:I:0	MotionDisabled	BOOL				
81 CHANNEL_HSC:0:0	ReferenceRequired	BOOL				
Bi PAX_HART_DEVICE:10	LoadRequired	BOOL				
81 05E1:DS4000PM_S107E207:00	PortRequired	BOOL				
Trends	Readuldle	BOOL				
Logical Model	Panels Development	ROOL				
I/O Configuration	KeadyProduction	BOOL				
4 🚍 5069 Backplane	ReadyFluidic	BOOL				
A A1/A2 Ethernet	ReadyReference	BOOL				
5069-L306ER TestPLC	ReadyLoad	BOOL				
Mek DS4000PM DS4000_1	ReadyPark	BOOL		~		

Figure 2, Module-Defined Data Type created automatically when EDS installed (Input)

Logix Designer - Te:	tPLC in CustomerExample_v2_3.ACD [5069-L30	06ER 34.11]								- 0	×
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👂 📁 Motion Groups									Type	Base	
👂 🚞 Alarm Manager									Alias For		
👂 📁 Assets									Base Tag		
The Logical Model									Data Type	05F1:DS4000PM 31(07E26
▲ ⊆ I/O Configuration	Dn								Scope	TestPLC	
4 5069 Backpl	ane								External Access	Read/Write	
4 - A1/A2 Ethe	LSUGER IESTPLC								Style		
Fig 5069-1 30	06ER TestPI C								Constant	No	
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									Visible		
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1= Controller Organizer	Logical Organizer	→ \ Monitor Tage	ags (Edit Tags /								
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Figure 3, Cyclical I/O Controller Tags created automatically when EDS installed

2.5. Viewing Module Parameters

Though only a some of the parameters are available in the Cyclical I/O Controller Tags, all DS4000 parameters are available in the Parameters tab of the Module Properties window. When connected online to the PLC, the values are displayed and are modifiable.

arameters	Group:	<all parameters=""> ∨</all>					
ternet Protocol	DA	Name		Value	Units	Style	
etwork	1	Productid		1		Decimal 🗸	Identifies the
	2	AdiMapMajorVersion		2		Decimal 🗸	Major version
	3	AdiMapMinorVersion		3	<u> </u>	Decimal V	Minor version
	4	FirmwareVersion		560010-0203			Version of the
	5	FirmwareCrc		1516669249		Decimal 🗸	CRC of the Fir
	6	PartNumber		520269-AABAA 🗸			lvek part numi
	7	SerialNumber		159880		Decimal 🗸	Serial number
	8	Bootloader Version		560013-0101			Version of the
	9	Enter Bootloader		0		Decimal 🗸	Force the con
	10	Commands					Contains com
	11	CommandsExt					Future comma
	12	StatusFlags		XXXX0010 00000000 00111111 00000011			Flags indicati
	13	StatusFlagsExt		XXXXXXXX XXXXXXXX XX00XXX0 00000000			Extended sta
	14	StatusState		IDLE 🗸			The status in
	15	FaultCode		0	1	Decimal 🗸	Fault code.
	Insert <u>F</u> a	ctory Defaults				(<u>S</u> et +
	The mode	values displayed here are r Ile when a connection is e	read direc stablished	ty from the module. These values are not stored in the . Click Set to write updated values to the module.	controlle	er and are not	sent to the

Figure 4, Accessing parameters using the Parameter tab within Studio 5000

Modifying values using the Parameters tab will modify the parameter value in the controller immediately. Due to the non-volatile nature of most parameters, modifications made to the parameters will be retained by the controller, even through a power-cycle. There are a few exceptions to this as some parameters are volatile (e.g., command and status parameters).

The Parameter tab contains a "Group" setting that allows groups of Parameters to be shown together according to categories defined by IVEK. The categories attempt to organize parameters in a way that indicate the way in which their values influence the system. The IVEK defined groups include: Information, Pump, Production, Fluidic, System, Operate, Statistics, and IVEK. Note that the entire list of parameters available on the DS4000 is available by selecting the "<All Parameters>" group.

The groups of parameters are listed in the table below.

Group	Example
<all parameters=""> This is the default setting when opening the Parameters tab. All of the IVEK defined Parameters are available. NOTE: when the DS4000 is offline, the "Value" fields will not be available.</all>	General Mode H0 Personeticity Personeticity Network Parameters Society All Parameters Dev Conjustion Network Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Network Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Network Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion Dev Conjustion </td
	Status: Running OK Cancel Booly Help
Information General information pertaining to the DS4000. These parameters are generally read- only.	General Parameters Connection Module Irlo Parameters Force Protection Image: Information Image: Information Image: Imag
	Status: Running OK Cencel Apply Help

Pump Parameters that relate to the Pump attached to the DS4000. Generally, these are only modified when the pump attached to the unit is changed. Some of these parameters do impact the fluidic profile of pumping operations (e.g., acceleration).	General Connection Module Ho Parameters Internet Protocol Per Configuation Network Status: Running	Strate Image: Strate Image: Strate
<u>Production</u> Parameters that relate to the Production Mode pumping operations.	General Connection Module into Parameters Internet Protocol Per Configuration Network Network	Parameters group: Reduction 1 0 <
<u>Fluidic</u> Parameters that relate to the Fluidic Setup Mode pumping operations.	General Connection Module Info Parameters Internet Protocol Port Configuration Network	Parameters group: Rude D 0 Rule D 0 Rule Rule D 0 Rule Rule Rule D 0 Rule Rule Rule Rule D 0 Rule Rul
	Status: Running	OK Cancel Apply Help



IVEK	General Connection Module Info	Paramet	ers		-	-	
These are for use by IVEK during factory setup or Technical Service troubleshooting.	 Nocue #0 Pearent Protocol Peor Chigueton Network Network Status: Running 	Group: 0 0 0 26 33 36 36 39 120 131 132 133 134 135 135 135 135 135 135 135 135	Ivek Name Name Name Name Name Notionation Name Notionation Name Notionation Name Notionation Name Name Name Name Name Name Name Name	Value	Units 0 mRev 0 cSec 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Style Decimal Decima	Add backlash b r How tong to delay Determines the ra The percent of m The percent of m Configuration dati Configuration dati Configuration data Guardian test are UCD test summary of an Summary of an

2.6. Accessing Parameters using MSG Function Block

The MSG function block may be used by the PLC software to access parameters that need to be modified or read during runtime, if they are not available in the cyclic I/O Tags. All parameters reside in the CIP Parameter Object class which is a standard object in the CIP specification.

The MSG function must contain the following:

- <u>Message Type:</u> select CIP Generic.
- <u>Service Type:</u> for reading parameters select "Parameter Read; for writing parameters select "Parameter Write". Selecting one of these Service Types will automatically populate Service Code, Class, and Attributes with the proper values.
- <u>Service Code:</u> "e" hex for Get Attribute Single, "10" hex for Set Attribute Single (populated automatically went Parameter Read or Parameter Write selected for Service Type).
- <u>Class:</u> "f" hex which is the value for the CIP Parameter Object class (populated automatically when Parameter Read or Parameter Write selected for Service Type).
- <u>Instance:</u> enter the parameter ID (decimal) for the desired parameter (see DS4000 product manual or the web pages for the parameter ID for each parameter).
- <u>Attribute:</u> "1" decimal for the Value attribute (populated automatically when Paramater Read or Parameter Write selected for Service Type). Other attributes are available as "A" hex for Minimum Value, "B" hex for Maximum Value, and "C" hex for Default Value see the CIP specification for more information.

Configuratio	on* Con	nmunication Ta	ag					
Message	<u>Ty</u> pe:	CIP Gener	ic		~			
Service Type:	Parame	ter Read		v	Source Element:			~
Service		warmen and service			Source Length:	0	-	(Bytes)
Code;	е	(Hex) <u>C</u> lass:	t	(Hex)	Destination	PumpM	lotor	~
Instance:	20	Attri <u>b</u> ute:	1	(Hex)	Element:	New	Tag	
) Enable	() En	able Waiting	() Star	rt	⊖ Done	Done Leng	th: 4	
) Enable) Error Cou ror Path: ror Text:	⊖ En Je: DS4000_	able Waiting Extende 1	⊖ Star ad Error C	rt Sode:	⊖ Done	Done Leng	th: 4 Dut 🕈	

Figure 5, Parameter Read command

2.7. Starting with the Example Project

An example project, using Ladder Logic, is located on the on the IVEK website (<u>https://www.ivek.com/manuals.html</u>).

Logix Designer - TestPLC in CustomerExample_v2_3.ACD [5069-L	JONER 34.11]
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1/O OK Rem Run No Forces 🕨	No Edits Q. 4 Favorites Add-On Alarma Bit Timer/Counter Input/Output Compare Compute/Math MoveLogical FleMlac, FleXShitt Sequencer F
troller Organizer 🛛 👻 🗄 🗙	📄 Module Properties: Local (DS4000PM 2.003) 📶 MainProgram - MainRoutine 🗴 🥏 Program Parameters and Local Tags - MainProgram
0	
Controller TestPLC	Interocks
Controller Tags	ESton OK DS4000 1 0 MotionEnable
Controller Fault Handler	
Tacks	
A C MainTask	Common Common Data
A b MainProgram	Contrait Contains and
Parameters and Local Tags	
1 MainRoutine	
Unscheduled	
Alarm Manager	D\$400_1.0.5kmProduction
Assets	* 10 22
he Logical Model	Step Pure 054000 1:0 Step Al
I/O Configuration	
4 🖬 5069 Backplane	
E9 [0] 5069-L306ER TestPLC	Load_Linear_Pump D54000_1:0.Start.oad
FD 5069-1 306FR TestPI C	A
MM DS4000PM DS4000 1	
	Cess_Alert DS4000_10.CHsarAlert
	Char Faut D54000 1.0.CharFaut
	Ironnor Pump Status bris
	DS4000_11ReadyHie DS4000_11Configured DS4000_11ReadyHie DS4000_1
dule Defined Tags	Ma Cyclical Production Parameters
Ø DS4000_11	MOV
cription	Source Pump_DapenseVol
sus Running	Dest D\$4000_1:0.DispenseVolume
dule Fault	
	9 Source DS4000 11LastFroductionVolume
	500+
	Dest Pump_LasDspenseVol
Controller Organizer	
Errors 🗖 Search Results 🛃 Watch	
	Communication Software Earton Talk Tiny Bring O of 15 align VED

Figure 6, Example Ladder Logic program

3. ACCESSING THE DS4000 USING SIEMENS TIA PORTAL

TIA Portal® is a development environment for Siemens PLCs. Accessing the DS4000 requires installing a GSD (GSDML) file into the workspace. The GSD file provides TIA Portal with the information needed to communicate with the DS4000 device.

The following instructions describe how to install the DS4000 in a TIA Portal project and how to read and modify parameters via cyclic I/O data exchange, and also via acyclic Read Data Record and Write Data Record services. These instructions were generated using an IVEK Digispense 4000, TIA Portal V19 and a SIMATIC S7-1200 PLC.

3.1. Adding the GSD file

The GSD file (e.g., GSDML-V2.45-IVEK Corporation-DS4000PM-20241107.xml) for the DS4000 must be imported into TIA Portal. The GSD file is located on the IVEK website (<u>https://ivek.com/manuals.html</u>).

Firmware Version	GSD File
560010-0101	Not supported
560010-0102	Not supported
560010-0201	Not supported
560010-0202	Not supported
560010-0203	Not supported
560010-0204	GSDML-V2.45-IVEK Corporation-DS4000- 20241206.xml

Make sure the installed GSD is the correct version for the specific DS4000 firmware version.

Note: if the DS4000 is in Bootloader mode, the DS4000 appears as a different device. Also, it is not certified as a PROFINET device in this mode, so removal from an existing PROFINET network is recommended. The GSD file does not contain the information necessary to connect a PLC to the DS4000 in bootloader mode. However, connection by a PLC is not necessary in order to access web pages and perform FTP transfers.

Instruction	Image
In the project view, from the Menu select Options->Manage general station description files (GSD).	Options Tools Window Help Y Settings Support packages Support packages Manage general station description files (GSD) Start Automation License Manager Image General station Image General station Image General station Start Automation Image General station Image Gene

In the pop-up window, use the "…" button to browse to the directory containing the GSD file(s). The files	Manage g	eneral station description files d GSDs GSDs in the project ath: Z:IVM_Share\projects\Custor	t merExample\A	dditionalFiles\	SSD	×
available in the directory appear in the	Content	of imported path				
Content of Imported noth costion	GSDX	File	Version	Language	Status	Info
Select the GSD file(s) to install and press the Install button.		gsdml-v2.45-ivek corporation-ds4	V2.45	English	Not yet installed	Flui
	<		Ш			>
				D	elete Install	Cancel
Verify that the GSD was installed successfully.	Installat	reneral station description files tion result ge stallation was completed successfully	у.			×
		Save log Install	additional file	s	Close	

3.2. Removing a GSD file

Sometimes it is necessary to remove an older version of a GSD.

Instruction	Image
In the project view, from the Menu select Options->Manage general station description files (GSD)	Options Tools Window Help Y Settings Support packages Support packages Manage general station description files (GSD) Start Automation License Manager Image Global libraries Image Global libraries

The pop-up window lists the GSD files that are already installed. Select the GSD that is being removed and press the Delete button. TIA Portal will	Manage s Installe Source p Content	general station description files ed GSDs GSDs in the project wath: Z:IVM_Sharelprojects\Custor t of imported path	t merExample	\AdditionalFiles\	GSD	×
indicate that the catalog is being updated.	GSD>	File gsdml-v2.45-ivek corporation-ds4	Version V2.45	Language English	Status Already installed	Info Flui
The pop-up window will now show the GSD as "Not yet installed".	Manage g Installe Source p	jeneral station description files ed GSDs GSDs in the projec ath: [Z:!VM_Sharelprojects\Custor	III t nerExample	AdditionalFiles	Delete Install	Cancel X
	Content	of imported path				
	GSDX	File gsdml-v2.45-ivek corporation-ds4	Version V2.45	Language English	Status Not yet installed	Info Flui
	<		1111	D	elete Install	Cancel

3.3. Adding the DS4000 to a Project

After installing the GSD file of the DS4000 to TIA Portal, the DS4000 is available for addition to a project. The following instructions show how to add a DS4000.

Instruction	Image

In the Project view, click on Devices &	Project tree 🔲 🖣
networks.	Dovices Plant objects
	Devices
	▼ Project1
	Add new device
	- Devices & networks
	► Ungrouped devices
	Security settings
	Cross-device functions
	🕨 📑 Common data
	Documentation settings
	Languages & resources
	Version control interface
	Online access
	Card Reader/USB memory
Choose the Network view tab, and browse	Hardware catalog 🛛 🗊 🔟 🕨
for the desired IVEK controller. E.g.,	Options
Hardware catalog: Other field devices-	
>PROFINET IO->General->IVEK	
PROFINET IO->General->IVEK Corporation->DS4000->DS4000PM V2.4.	✓ Catalog
Corporation->DS4000->DS4000PM V2.4.	✓ Catalog <search> init init</search>
Corporation->DS4000->DS4000PM V2.4.	✓ Catalog <search> M↓ M1 ✓ Filter Profile: <all></all></search>
PROFINET IO->General->IVEK Corporation->DS4000->DS4000PM V2.4.	✓ Catalog <search> Image: Search > Image: Search > <</search>
Corporation->DS4000->DS4000PM V2.4.	✓ Catalog <search> Image: Search and the search and the</search>
Corporation->DS4000->DS4000PM V2.4.	✓ Catalog Search> Filter Profile: <all> Image: Controllers HMI PC systems</all>
Corporation->DS4000->DS4000PM V2.4.	✓ Catalog Search> Filter Profile: <all> Controllers Im Controllers Im PC systems Im Prives & starters Im Drives & starters</all>
PROFINET IO->General->IVEK Corporation->DS4000->DS4000PM V2.4.	 ✓ Catalog <search></search> ✓ Filter Profile: <all></all> ✓ Controllers ✓ Controllers ✓ HMI ✓ PC systems ✓ Drives & starters ✓ Network components ✓ Detecting & Monitoring
PROFINET IO->General->IVEK Corporation->DS4000->DS4000PM V2.4.	 ✓ Catalog <search></search> ✓ Filter Profile: <all></all> ✓ Controllers ✓ HMI ✓ PC systems ✓ Drives & starters ✓ Network components ✓ Detecting & Monitoring ✓ Distributed I/O
PROFINET IO->General->IVEK Corporation->DS4000->DS4000PM V2.4.	 ✓ Catalog <search></search> ✓ Filter Profile: <all></all> ✓ Controllers ✓ Controllers ✓ HM ✓ PC systems ✓ Drives & starters ✓ Detecting & Monitoring ✓ Distributed I/O ✓ Power supply and distribution
>PROFINET IO->General->IVEK Corporation->DS4000->DS4000PM V2.4.	✓ Catalog <search> ✓ Filter Profile: ✓ Filter Profile: ✓ Controllers ✓ Controllers ✓ HMI ✓ PC systems ✓ Drives & starters ✓ Network components ✓ Detecting & Monitoring ✓ Distributed I/O ✓ Power supply and distribution ✓ Field devices</search>
>PROFINET IO->General->IVEK Corporation->DS4000->DS4000PM V2.4.	✓ Catalog <search> ✓ Filter Profile: ✓ Filter Profile: ✓ Controllers ✓ Controllers ✓ HMI ✓ PC systems ✓ Drives & starters ✓ Network components ✓ Detecting & Monitoring ✓ Distributed I/O ✓ Power supply and distribution ✓ Field devices ✓ Other field devices</search>
PROFINET IO->General->IVEK Corporation->DS4000->DS4000PM V2.4.	 ✓ Catalog ✓ Search> ✓ Filter Profile: <all></all> ✓ Controllers ✓ Controllers ✓ HMI ✓ HMI ✓ PC systems ✓ Drives & starters ✓ Detecting & Monitoring ✓ Distributed I/O ✓ Power supply and distribution ✓ Field devices ✓ Other field devices ✓ Other field devices ✓ Additional Ethernet devices
>PROFINET IO->General->IVEK Corporation->DS4000->DS4000PM V2.4.	 ✓ Catalog ✓ Search> ✓ Filter Profile: <all></all> ✓ Controllers ✓ Controllers ✓ HMI ✓ PC systems ✓ Drives & starters ✓ Detecting & Monitoring ✓ Distributed I/O ✓ Power supply and distribution ✓ Field devices ✓ Other field devices ✓ Additional Ethernet devices ✓ ROFINET IO
>PROFINET IO->General->IVEK Corporation->DS4000->DS4000PM V2.4.	 ✓ Catalog <search></search> ✓ Filter Profile: <all></all> ✓ Controllers ✓ Controllers ✓ HMI ✓ PC systems ✓ Drives & starters ✓ Network components ✓ Detecting & Monitoring ✓ Distributed I/O ✓ Distributed I/O ✓ Power supply and distribution ✓ Field devices ✓ Other field devices ✓ Other field devices ✓ ROFINET IO ✓ Prives
>PROFINET IO->General->IVEK Corporation->DS4000->DS4000PM V2.4.	 ✓ Catalog ✓ Search> ✓ Filter Profile: <all></all> ✓ Controllers ✓ Controllers ✓ HMI ✓ PC systems ✓ Drives & starters ✓ Detecting & Monitoring ✓ Distributed I/O ✓ Power supply and distribution ✓ Field devices ✓ Other field devices ✓ Other field devices ✓ PROFINET IO ✓ Proves ✓ Encoders
>PROFINET IO->General->IVEK Corporation->DS4000->DS4000PM V2.4.	 ✓ Catalog <search></search> ✓ Filter Profile: <all></all> ✓ Controllers ✓ Controllers ✓ HM ✓ PC systems ✓ Drives & starters ✓ Detecting & Monitoring ✓ Distributed I/O ✓ Power supply and distribution ✓ Field devices ✓ Other field devices ✓ Other field devices ✓ PROFINETIO ✓ PROFINETIO ✓ Drives ✓ Encoders ✓ Gateway
>PROFINET IO->General->IVEK Corporation->DS4000->DS4000PM V2.4.	 ✓ Catalog ✓ Search> ✓ Filter Profile: <all></all> ✓ Controllers ✓ Controllers ✓ HMI ✓ PC systems ✓ Drives & starters ✓ Drives & starters ✓ Detecting & Monitoring ✓ Distributed I/O ✓ Power supply and distribution ✓ Field devices ✓ Other field devices ✓ Other field devices ✓ PROFINET IO ✓ PROFINET IO ✓ Encoders ✓ General ✓ WEK Comporation
>PROFINETIO->General->IVEK Corporation->DS4000->DS4000PM V2.4.	 ✓ Catalog <search></search> ✓ Filter Profile: <all></all> ✓ Controllers ✓ Drives & starters ✓ Detecting & Monitoring ✓ Distributed I/O ✓ Distributed I/O ✓ Distributed I/O ✓ Power supply and distribution ✓ Power supply and distribution ✓ ProoFineTrio ✓ Motional Ethernet devices ✓ ProoFineTrio ✓ Controllers ✓ Gateway ✓ General ✓ VEK Corporation ✓ VEK Corporation
>PROFINETIO->General->IVEK Corporation->DS4000->DS4000PM V2.4.	 ✓ Catalog ✓ Search> ✓ Filter Profile: <all></all> ✓ Controllers ✓ HMI ✓ PC systems ✓ Drives & starters ✓ Detecting & Monitoring ✓ Detecting & Monitoring ✓ Distributed I/O ✓ Power supply and distribution ✓ Field devices ✓ Other field devices ✓ Other field devices ✓ PROFINET IO ✓ Proves ✓ Encoders ✓ General ✓ ✓ IVEK Corporation ✓ ✓ DS4000 ✓ ✓ Head module
>PROFINETIO->General->IVEK Corporation->DS4000->DS4000PM V2.4.	 ✓ Catalog Search> ✓ Filter Profile: <all></all> ✓ Controllers ← HM ← C systems ← Drives & starters ← Detecting & Monitoring ← Detecting & Monitoring ← Detecting & Monitoring ← Distributed I/O ← Power supply and distribution ← Field devices ← Other field devices ← Other field devices ← PROFINET IO ← Drives ← Encoders ← General ← ↓ IVEK Corporation ← ↓ DS4000 ← ↓ Head module ▲ DS4000BT V2.4
>PROFINETIO->General->IVEK Corporation->DS4000->DS4000PM V2.4.	✓ Catalog ✓ Search> ✓ Filter Profile: ✓ Filter Profile: ✓ Image: Controllers ✓ Image: Controlers ✓ Image: Controllers <



3.4. Using Cyclical I/O Controller Tags

After the DS4000 is installed in the project, there are several modules available to exchange cyclic I/O data between the DS4000 and PLC. The modules are automatically fixed in specific slots. Each module represents a Parameter that is available for cyclic exchange. These Parameters are useful for real-time control of the pump operations. There are modules/parameters in both the Input and Output directions. Detailed information about each of the parameters contained in the module mapping is available in the DS4000 product manual.

Not all parameters are available as modules, only the subset necessary for real-time control of the pumping operations.

To use these parameters in the PLC, each module needs to be mapped to either I addresses or Q addresses. TIA Portal automatically fills in the I addresses and Q addresses when the DS4000 is inserted into the project.

Setup of Digispense $\ensuremath{\mathbb{R}}$ 4000 with PLCs and Gateways IVEK Corporation

If the I addresses and Q addresses are chosen to traverse the modules in order, it is possible to overlay tags to better identify each parameter. An example of this is shown in Figure 7, Figure 8, and Figure 9.

 ds4000bt1 Interface 	0				
Interface		0			DS4000BTV2.3
	0	0 X1			ds4000bt
P10_1	0	1		100103	P10
P11_1	0	2		104107	P11
P18_1	0	3		108	P18
P143_1	0	4		109	P143
P144_1	0	5		110111	P144
P52_1	0	6		112115	P52
P76_1	0	7		116119	P76
P12_1	0	8	100103		P12
P13_1	0	9	104107		P13
P14_1	0	10	108		P14
P139_1	0	11	109		P139
P140_1	0	12	110111		P140
P17_1	0	13	112		P17
P141_1	0	14	113		P141
P142_1	0	15	114115		P142
P15_1	0	16	116119		P15
P16_1	0	17	120123		P16
P91_1	0	18	124127		P91

Figure 7, I and Q addresses in order

Cus	tome	erExample + PLC_1 [CPU 12	11C DC/DC/DC] >	PLC tags > DS	4000 [2]			
100	- Be								
11	DS40	00							
		Name	Data type	Address	Retain	Acces	Writa	Visibl	Comment
1	-00	DS4000_PD_In	*DS4000_PD	%1100.0 💌					
2	-00	statusFlags	Status_T	%1100.0		1		1	
3		statusFlagsExt	StatusFlagsExt_T	%1104.0		1	~	V	
4	-	statusState	USInt	%IB108		1	V	v	
5	-	reserved139	USInt	%IB109		V	v	V	
6	-	reserved140	UInt	%IW110		1	 Image: A start of the start of	V	
7		currentRecipe	USInt	%IB112		1	v		
8		reserved141	USInt	%IB113		1	v	v	
9	-	reserved142	UInt	%IW114		V		v	
10	-	codeFault	UDInt	%ID116		1	8	1	
11		codeAlert	UDInt	%ID120		1	v	V	
12	-	volumeLastProduction	UDInt	%ID124		1	V	V	
13	-	rateActual	UDInt	%ID128		V	v	V	
14	-	DS4000_PD_Out	"DS4000_PD_O	%Q100.0					
15		<add new=""></add>				1		2	

Figure 8, Tags for Input Parameters

Cus	tom	erE	xa	ample > PLC_1 [CPU	1211C DC/DC/DC] •	PLC tags	DS	4000 [2]			
100	1¢			+ 🕆 🖬 7								
[540	000)									
ļ		Na	me	e	Data type	Address		Retain	Acces	Writa	Visibl	Comment
1	-00	•	D	S4000_PD_In	*DS4000_PD	%1100.0					S	
2	-00	•	D	S4000_PD_Out	"DS4000_PD_O	%Q100.0	- U.					
з			•	commands	Commands_T	%Q100.0			\checkmark	\checkmark	~	
4			+	commandsExt	CommandsExt_T	%Q104.0			2	1	8	
5				getRecipe	USInt	%QB108			v	 Image: A start of the start of	4	
6				reserved143	USInt	%QB109			v	1	2	
7				reserved144	UInt	%QW110			1	\checkmark	1	
8				volumeDispense	UDInt	%QD112			\checkmark	V	8	
9				rateOrSetpoint	UDInt	%QD116			V	\checkmark	1	
10			4	Add new>					V	2	2	

Figure 9, Tags for Output Parameters

Once there are tags overlayed with the I addresses and Q addresses, the data still requires some transformation due to endianness of bit arrays. In particular, statusFlags, statusFlagsExt, commands, and commandsExt require byte swapping so that the bit locations will match the locations in the DS4000 product manual. Examples of how to swap these parameters are shown in Figure 10 and Figure 11.



Figure 10, Swapping Status Bits



Figure 11, Swapping Command Bits

Setup of Digispense $\ensuremath{\mathbb{B}}$ 4000 with PLCs and Gateways IVEK Corporation

AN-101 REV B Page 24 of 44 These examples may be part of a Function Block that executes before any of the data is used by the PLC program. Figure 12 and Figure 13 show examples of function blocks performing these functions.







Figure 13, FB to Move from PLC to DS4000

3.5. Modifying DS4000 Parameters

Though some of the DS4000 parameters are available via cyclic I/O data, all of the parameters are available using Read Data Record and Write Data Record services (acyclic). These services are available using the RDREC and WRREC function blocks.

The RDREC function block contains the following inputs:

- \underline{EN} the enable bit for the function block.
- <u>REQ</u> a trigger to request the read of the data record.
- <u>ID</u> the address of the head module in the DS4000 (e.g., ds4000pm1~Head). This is a System constant automatically generated by TIA Portal and visible in the Device view ->System Constants tab, for the DS4000.
- <u>INDEX</u> this is the Parameter ID of the desired parameter to read. The DS4000 product manual lists every available parameter including its ID. (For example, the Dispense Volume parameter ID is 52).
- <u>MLEN</u> this is the length of the desired parameter to read. The DS4000 product manual lists every available parameter including its data type, and a length for each data type. (For example, the Dispense Volume type is VOL, which is equivalent to a DINT, which is 4 bytes).
- <u>RECORD</u> this is a location to place the parameter upon a successful read.

The WRREC function block contains the following inputs:

- <u>EN</u> the enable bit for the function block.
- <u>REQ</u> a trigger to request the write of the data record.
- <u>ID</u> the address of the head module in the DS4000 (e.g., ds4000pm1~Head). This is a System constant automatically generated by TIA Portal and visible in the Device view ->System Constants tab, for the DS4000.
- <u>INDEX</u> this is the Parameter ID of the desired parameter to write. The DS4000 product manual lists every available parameter including its ID. (For example, the Dispense Volume parameter ID is 52).
- <u>MLEN</u> this is the length of the desired parameter to write. The DS4000 product manual lists every available parameter including its data type, and a length for each data type. (For example, the Dispense Volume type is VOL, which is equivalent to a DINT, which is 4 bytes).
- <u>RECORD</u> this is a location to place the parameter upon a successful read.

3.6. Starting with an example project

An example project, using Ladder Logic, is located on the on the IVEK website (<u>https://www.ivek.com/manuals.html</u>).

M Siemens - Z:\VM_Share\projects\CustomerExample\CustomerExample		_ # X
Project Edit View Insert Online Options Tools Window Help		Totally Integrated Automation
📑 🔁 🔂 Save project 🚊 🐰 🕮 🖹 🗙 崎 🏝 🖓 2 (24 2) 🔂 🛄 📓 🖓	, 💋 Goonline 🖉 Gooffline 🛔 🖪 🖪 🗶 😑 💷 🔣 🔣 🤜earch in project	PORTAL
Project tree II 4 CustomerExample > PLC_1 [CPU 121	IC DC/DC/DC] Program blocks Main [OB1]	_ # = × 🚺
Devices 4 +		-0
	・ 2 * 2 * 三部 他に相知知道にし、「自己」をでし、	
Main		
Add new device A Name Da	ita type Default value Comment	
🛔 Devices & networ 👘 1 📲 🔻 Input		
PLC_1 [CPU 121 2 🚭 🔹 Initial_Call Bo	Jol Initial call of this OB	
B Device config 3 C • Remanence Bo	ol –True, if remanent data are available	× 1
S Online & diag ▼ Reprogram blocks → + + + + + + + + + + + + + + + + + + +		est
Add new		
- Main [OB1]		· ·
MovePD_F =	"Data_block_1".	E.
MovePD_T "Data block 1".	commands.	- Tas
ReadPara inactiveEstop	enableMotion	= 5
MovePD F	()(
MovePD_T		
System bl	"Deta_block_1".	Libra Libra
Technology c "Data_block_1". "Data_block_1". Data_block_1".	"Data_block_11", "Data_block_11", D54000_PD_In, "Data_block_11", "Data_block_11", "Data_block_11",	arie
statusFlags. statusFlags.	statusflags. statusflags. required statusflags.ready statusflags.ready statusflags.busy "Data_block_1".	in
Show all t	faulted requiredLoad Reterence Idle Production AnyOperation outputDummy	5
Add new t		1 A
🍇 Default ta		
3 DS4000 [2]	"Deta_block_1".	25
PLC data types Data block 1*	DS4000_PD_Out. commands.start	
StartPump	Reference	
Reference	operation	
Gore UA com		×
Device proxy		100%
Program info Main [OB1]		💁 Properties 🚺 Info 🚺 💆 Diagnostics 👘 👘 🗸
General Texts		
Distributed I/O General		^
Gen	361	
 Big Security settings Time stamps 		
Compilation	Name: Main	
Details view Attributes	Namespace:	
	Constant name: OB_Main	
	Туре: ОВ	
Name	Event class: Program cycle	
	Language: LAD	
	Number: 1	
< II >	() Manual	v
🖌 Portal view 🔚 Overview 📲 2 PLC tags 🔒 🍯 3 Data	bloc 🔒 ds4000bt1 🛛 🖶 4 Code block 🔒	Project CustomerExample opened.

Figure 14, Example Ladder Logic Program

3.7. Accessing DS4000 EtherNet/IP version using TIA Portal

While PROFINET is the recommended fieldbus for use with Siemens' PLCs, it is possible to communicate between a Siemens' PLC and an DS4000 EtherNet/IP version. TIA Portal offers a "LCCF_EnetScanner" function block that may be used for this purpose. Please refer to the Siemens' document, "EtherNet/IP Scanner for SIMATIC".

4. ACCESSING THE DS4000 USING BECKHOFF TWINCAT 3

TwinCAT® 3 is a development environment for Beckhoff PLCs. Accessing the DS4000 requires placing an ESI file into the appropriate directory so that TwinCAT may access it. The ESI file provides information for TwinCAT to access the CANopen Dictionary upon addition of a DS4000 to a project.

The following instructions describe how to install the DS4000 in a TwinCAT 3 project and how to read and modify parameters via the CoE – Online data, the FB_EcCoESdoRead() and FB_EcCoESdoWrite() function blocks, and the Cyclical I/O Controller Tags. These instructions were generated using and IVEK Digispense 4000, TwinCAT 3 and a PC.

4.1. Adding the ESI File

The ESI file (e.g., lvek_DS4000_v2_4.xml) for the DS4000 must be imported into TwinCAT 3. The ESI file is located on the IVEK website (<u>https://ivek.com/manuals.html</u>).

Firmware Version	ESI File
560010-0101	Not supported
560010-0102	Not supported
560010-0201	Not supported
560010-0202	Not supported
560010-0203	IVEK_DS4000_v2_3.xml
560010-0204	IVEK_DS4000_v2_4.xml

Note: if the DS4000 is in Bootloader mode, the DS4000 appears as a different device. Also, it is not verified as an EtherCAT device in this mode, so removal from an existing EtherCAT network is recommended. The ESI file, IVEK_DS4000_v2_4.xml, contains the information necessary to connect a PLC to the DS4000 in bootloader mode. This is necessary in order to order to access web pages and perform FTP transfers (EtherCAT over Ethernet (EoE) must be enabled).

Instruction	Image
Add the IVEK ESI (e.g., IVEK_DS4000_v2_4.xml) to the TwinCAT directory (e.g., "c:\TwinCAT\3.1\Config\lo\EtherCAT")	EtherCAT × + - × ← ↑ C > ···· 3.1 > Config > to > EtherCAT > O New ~ Ko C C > ···· 3.1 > Config > to > EtherCAT > Search EtherCAT O New ~ Ko C C C Image: Config > to > EtherCAT > Search EtherCAT Image: Concurrents Image: Concurrents

TwinCAT reads the ESI upon opening a new System Manager window. If a System Manager window is already open, the ESI read may be initiated by the user. From the Menu, select TwinCAT->EtherCAT Devices- >Reload Device Descriptions.	4		INCAT TwinSAFE PLC Team Scope Too Windows Activate Configuration Restart TwinCAT System Restart TwinCAT Config Mode) Reload Devices Scan Toggle Free Run State Show Sub Items Hide Disabled Items Software Protection Access Bus Coupler/IP Link Register Update Firmware/EEPROM Show Realtime Ethernet Compatible Devices File Handling Selected Item EtherCAT Devices	ols V	Indow Help
		Ŕ	TcProjectCompare Multiuser Explorer Target Browser AutomationML Bode Plot Filter Designer About TwinCAT		Reload Device Descriptions Manage User Defined Blacklist Manage User Defined Blacklist

4.2. Removing an ESI file

When removing an ESI file, simply remove it from the TwinCAT directory.

Instruction	Image
Delete the IVEK ESI (e.g., IVEK_DS4000_v2_3.xml) from the TwinCAT directory (c:\TwinCAT\3.1\Config\Io\EtherCAT)	EtherCAT × + - - × ← → C → ·:: 3.1 > Config > Io > EtherCAT > Search EtherCAT • New × & O O O O Io > EtherCAT > Search EtherCAT • New × & O O O Io Search EtherCAT > Details • Documents * • Name Sechoff EtherCAT Search D/14/2024 1211 AM XML File 5/2 KB • Beckhoff EtherCAT Terminals 9/14/2024 1211 AM XML File 7/4 KB 5/4 KB • Beckhoff FEDXX 9/14/2024 1211 AM XML File 2/4 KB • Beckhoff FEDXX 9/14/2024 1211 AM XML File 2/4 KB • Beckhoff FEDXX 9/14/2024 1211 AM XML File 2/4 KB • Beckhoff FM2xxx 9/14/2024 1211 AM XML File 2/4 KB • Beckhoff FM2xxx 9/14/2024 1211 AM XML File 2/4 KB •



4.3. Adding the DS4000 to a Project

After installing the ESI file of the DS4000 to TwinCAT 3, the DS4000 is available for addition to a project. The following instructions show how to add a DS4000. Note that there is an alternative way to add a DS4000 by scanning the network for devices; those instructions are not provided.

Instruction	Image		
Add a new I/O Device to the project by selecting I/O- >Devices and opening the context menu. Select Add New Item.	Solution Explorer	Add New Item Add Existing Item Rename Add New Folder Export EAP Config File Scan Paste Paste Paste with Links	Ins Shift+Alt+A Ctrl+V

The project needs an EtherCAT Master to communicate with the DS4000 Slave. Select an EtherCAT Master, provide a name for the device, and press the Ok button.	Insert Device X Type: Image: EtherCAT Master Image: EtherCAT Slave Image: Cancel Image: EtherCAT Automation Protocol (Network Variables) Image: Cancel Image: EtherCAT Automation Protocol (Network Variables) Image: Cancel Image: EtherCAT Automation Protocol (Network Variables) Image: Cancel Image: EtherCAT Simulation Image: Cancel Image: EtherCAT Simulation Image: Cancel Image: EtherCAT Open Mode Adapter Image: Cancel Image: CANopen Image: Cancel Image: EtherCAT Cance Image: Cancel Image: EtherCAT Image: Cancel Image: Cancel Image: EtherCAT Cancel Image: Cancel Image: CANopen Ima	
Select the Network interface that is connected to the DS4000 and press the Ok button.	Device Found At X [none] Bluetooth Network Connection (Bluetooth Device (Personal Area Network Ethermet Inite(IR) Ethernet Connection (14) (219-LM) OK Wi-Fi (Intel(R) Wi-Fi 6E AX210 160MHz) Cancel Ethermet 2 (Sophors SSL VPN Adapter) OLcal Area Connection* 1 (Microsoft Wi-Fi Direct Virtual Adapter) Ethermet 3 (Realtek USB GbE Family Controller) OLcal Area Connection* 2 (Microsoft Wi-Fi Direct Virtual Adapter #2) Help Help	





4.4. Using Cyclical I/O Controller Tags

The cyclical I/O data available are shown in the PDO Mappings of the DS4000 device (e.g., Box 1). To see the PDO Mappings, expand the arrow next to the DS4000. This data contains several parameters that are useful for real-time control of the pumping operations. There are PDOs available in both the Transmit and Receive directions. Detailed information about each of the parameters contained in the PDO mappings is available in the DS4000 product manual.

Not all parameters are available as PDO mappings, only the subset necessary for real-time control of the pumping operations. The PDO mappings are exchanged between the PLC and the DS4000 using the EtherCAT network when the DS4000 is in the OP state.

To use the PDO fields in a program, the PDO fields need to be mapped to Tags.



PDO Mappings of the DS4000 shown in a TwinCAT project

4.5. Viewing Module Parameters

Though only some of the parameters are available in the PDO mappings, all DS4000 parameters are available in the "CoE – Online" tab of the DS4000 window (to see this window, double click on the DS4000 device). When connected to the PLC, and in either the PRE-OP, SAFE-OP, or OP state, the values are displayed and are modifiable.

neral Ether	CAT Proces	s Data Startup CoE - C	Online Online		
Update	List	🗌 Auto Update 🛛 🗹	Single Update 🗌	Show Offline Data	
Advanc	æd				
Add to St	artup	Online Data	Module OD (A	oE Port): 0	
Index	Name		Flags	Value	Unit
2001	PRODU	CTID	RO	0x0000003 (3)	
2002	ADI MAI	P MAJOR VERSION	RO	0x0002 (2)	
2003	ADI MAI	P MINOR VERSION	RO	0x0003 (3)	
2004	FIRMW	ARE VERSION	RO	560010-02CD	
2005	FIRMW	ARECRC	RO	0x7D8F1DE3 (2106531299)	
2006	PART N	UMBER	RO	520274-AACAA (11)	
2007	SERIAL	NUMBER	RO	0x00026A58 (158296)	
2008	BOOTLO	DADER VERSION	RO	560013-0101	
2009	ENTER	BOOTLOADER	RO	FALSE	
200A	COMMA	NDS	RW P	0x0000000 (0)	
200B	COMMA	NDS EXTENDED	RW P	0x0000000 (0)	
200C	STATUS	S FLAGS	RO P	0x00000119 (281)	
200D	STATUS	S FLAGS EXTENDED	RO P	0x0000000 (0)	
200E	STATUS	S STATE	RO P	FEEDING (24)	
200F	FAULT	CODE	RO P	0x0000000 (0)	
2010	ALERT	CODE	RO P	0x00000BC2 (3010)	
2011	RECIPE		RO P	0×00 (0)	
2012	RECIPE	GET	RW P	0x00 (0)	
2013	RECIPE	SAVE	RW P	0x00 (0)	
2014	PUMP N	NOTOR	RW	NONE (0)	
2015	PUMP S	SIZE	RW	NONE (0)	
2016	PUMP L	JNITS	RW	REV, REV/s (0)	
2017	PUMP T	YPE	RO	NONE (0)	
2018	PUMP C	HAMBER VOLUME	RW	0x00002710 (10000)	
2019	PUMP F	RESOLUTION	RO	0x0000001 (1)	
201A	RATE R	ESOLUTION	RO	0x0000001 (1)	
201B	INVERT	PUMP PORTS	RW	FALSE	

Example of accessing parameters using the "CoE – Online" tab within TwinCAT 3

Modifying values using the "CoE – Online" tab will modify the parameter value in the controller immediately. Due to the non-volatile nature of most parameters, modifications made to the parameters will be retained by the controller, even through a power-cycle. There are a few exceptions to this as some parameters are volatile (e.g., command and status parameters).

4.6. Accessing the parameter via Sdo functions

The FB_EcCoESdoRead and FB_EcCoESdoWrite function blocks may be used by the PLC software to access parameters that need to be modified or read during runtime, if they are not available in the cyclic I/O Tags. All parameters reside in the CANopen dictionary.

The functions must contain the following:

- <u>sNetId:</u> the network ID of the EtherCAT master.
- <u>nSlaveAddr:</u> the address of the DS4000.

Setup of Digispense $\ensuremath{\mathbb{B}}$ 4000 with PLCs and Gateways IVEK Corporation

- <u>nSubIndex:</u> a subindex of the object, typically 0 for the IVEK parameters.
- <u>nIndex:</u> the address of the parameter (see section 4.5 for one way to view the index of the parameters).
- <u>pSrcBuf</u>: a pointer to the variable to read/write.
- <u>cbBufLen</u>: the length of the variable to read/write. This length must match the length of the parameter (see lvek manual for length of each parameter).



Figure 15, Parameter Write command

4.7. Starting with the example project

An example project, using Ladder Logic, is located on the on the IVEK website (<u>https://www.ivek.com/manuals.html</u>).

CustomerExample - TcXaeShell		Quick Launch (Ctrl+Q) 🔑 🗕 🗗 🗙
Eile Edit View Project Build FBD/LD/IL Debug TwinCAT	1 TwinSAFE PLC Team Scope Jools Window Help	
O - O お・1a - 🖕 🗎 🏕 🗶 印 白 フ - C - Rele	ase - TwinCATRT (x64) - 🕨 Attach 👘 - 👘 🏓 🐨 🛱 🍪 🖄	
Build 4024.35 (Loaded) 🔹 💒 🛄 🚺 😂 🔨 🎯 🍋 %	WinCAT Project <local customerizample="" td="" ·="" ·<=""><td></td></local>	
Solution Explorer + # ×	Library Manager # MAIN • ×	Properties • # ×
004H-10-0 / -		√ Filter • K\$ Sort by • ≜↓Sort order •
Search Solution Explorer (Ctrl+;)	Scope Name Address Data type Initialization Comment Attributes	Property Value
Stanth Stanton Taylores (Chr.) P - Constant Taylores (Chr.) Chr. Constant Chr. Constant Chr. Constant Chr. Constant Chr. Constant Chr. Ch	Sopp Nume Address Data type Initialization Connect Attributes • <td< th=""><th>Property Value</th></td<>	Property Value
🕫 DevState		
Frm0Ctrl		
Frm0WcCtrl		Description
A CalinfoData		vescription
😴 ChangeCount 🧅		
Solution Explorer Team Explorer	Watch 1 Error List Ovdput	Properties Toolbox
C Ready		↑ Add to Source Control ▲



4.8. Accessing DS4000 EtherNet/IP version using TwinCAT

While EtherCAT is the recommended fieldbus for use with Beckhoff PLCs, it is possible to communicate between a Beckhoff PLC and an DS4000 EtherNet/IP version. TwinCAT offers an EtherNet/IP Scanner software device that may be used for this purpose. Please refer to the Beckhoff document, "EtherNet/IP Scanner for SIMATIC".

5. CONNECTING TO THE CONTROLLER WITH HTTP AND/OR FTP

DS4000 controllers that contain either an EtherNet/IP, PROFINET, or an EtherCAT interface module, also contain an HTTP server and an FTP server. The HTTP server delivers web pages to a browser for reading and writing the parameters of the controller. The FTP server provides services to transfer documentation files from the controller (e.g., EDS file).

In order to access these servers, the controller needs to be connected to the same network as the browsing device (e.g., computer) and the controller needs to be configured with a valid IP address.

For EtherCAT devices, the device must be online and in either the Pre-Op, Safe-Op, or Op state. Also, EoE must be enabled by the EtherCAT Master. The Customer Example project may be used as a starting point. After opening the project, use TwinCAT to place the EtherCAT Master and DS4000 into either Pre-Op, Safe-Op, or Op.

nCAT Projec	ct1 ⊹⊧	× Library Manager	a Main (C	Online]			
ieneral Ada	apter E	therCAT Online CoE	- Online				
No	Addr	Name	State		CF	RC	
	1001	D34000_1(D34000F	M) FRE	OF LINK_MIS L	U,	U	Request 'INIT' state Request 'PREOP' state Request 'SAFEOP' state Request 'OP' state Request 'BOOTSTRAP' state Clear 'ERROR' state EEPROM Update Firmware Update
Actual State	Pre-Op CRC	PREOP Safe-Op Op Clear Frames	Counter Send Frames Frames / sec Lost Frames Tx/Rx Errors	Cyclic 44021 99 8 0	+ + + /	Queu 16788 30 1 0	Advanced Settings Export List Properties

Figure 17, Requesting EtherCAT operating modes

5.1. Configuring the IP address

A utility, IPConfig, is needed to configure the IP address of the DS4000 controller. The IPConfig utility is available for download from the IVEK website.

The IPConfig utility scans an Ethernet network for DS4000 controllers and provides the ability to modify the IP address and DHCP setting. After installing the utility, the following instructions show how to configure the IP address of the DS4000.

Instruction	Image
-------------	-------

Press the Settings button to open the settings dialog for IPConfig.	IPconfig — X IP / SN GW DHCP Version Type MAC 0.0.0 0.0.0 0.0.0 On 1.01 DS4000 00-30-11-1F-AE-4B
Choose whether to broadcast from a specific NIC or over all available NICs. It is necessary to broadcast on whichever NIC is attached to the same network as the DS4000. Press the OK button.	Settings × Network Interface Image: Provide the set of the se
Press the Scan button. Any DS4000s that are attached the same network as the broadcasting NIC(s) appear in the list along with information about the DS4000. Double click anywhere within the row containing the information of the DS4000.	IP / SN GW DHCP Version Type MAC 0.0.0 0.0.0 0.0.0 0n 1.01 DS4000 00-30-11-1F-AE-4B

Configure the DS4000 for the	Configure: 00-30-11-1F-AE-4B ×				
desired network configuration.	Ethernet configuration				
To configure the DS4000 to					
abtain it's ID address from a	Subnet mask:				
obtain it's iP address from a	COff				
DHCP server (default) select					
	Default gateway:				
the On radio button in the					
DHCP section and then press	Primary DNS:				
Drich section and then press					
the set button.					
	Secondary DNS:				
	Hestermer				
	Password: Change password				
	New password:				
	Set Cancel				
To configure the DS4000 to	Configure: 00-30-11-1E-∆E-4B				
To conligure the DO4000 to					
use a static IP address, first	- Ethernet configuration				
able at the Off radio button in					
select the On radio button in	IP address: 192.168.1.1				
the DHCP section. This will	C On				
	Subnet mask: 255 255 0				
unlock the IP address, subnet	• Off				
mask and Default dateway					
mask, and Delault galeway	Default gateway:				
fields. Type in the desired IP					
address and subhet mask and	Primary UNS:				
then press the set button.					
	Secondary DNS:				
	Hostname:				
	Password:				
	New password:				
	Set Concol				
	Set Lancel				
After configuring the DS4000					
the new information will display	IP / SN GW DHCP Version Tune MAC				
in the information of	192.168.1.1 255.255.255.0 0.0.0.0 Off 1.01 DS4000 00-30-11-1F-4F-4B				
in the information row (may					
need to press the Scan button					
to update the display). The					
sottings are solved in nen					
settings are saved in non-					
volatile memory on the					
EtherNet/IP module of the					
DS4000					
	Settings Scan Exit				

5.2. Accessing the DS4000 via HTTP

All parameters are available by browsing the web pages provided by the HTTP server. The web pages are accessed using a standard web browser and the IP address of the DS4000 controller as the destination address.

The web pages have a little bit of security to limit access by unauthorized users. Upon browsing to the web page, the web browser will ask for a user name and password. The user name is "Supervisor" and the password is contained in a separate Tech Bulletin (should be included with your unit, or ask your Sales representatives to provide the password to you). This password is not able to be changed.

Several pages are available that provide access to the various parameters. The parameters have been grouped into seven categories (Information, Production, Fluidic, Pump, System, Statistics, Operation) in order to facilitate understanding. Parameters that are modifiable will have a "Set" button listed to the right of the value; parameters that are read-only will have not have a "Set" button available. There are also web pages that provide information about the network statistics, and other web pages that provide help (e.g., how to contact IVEK for Technical Support).



Figure 18, Accessing parameters using a web page

5.3. Accessing the DS4000 using FTP

The File Transfer Protocol (FTP) server provides access to documentation stored on the DS4000 file system such as the EDS file and icon. The following instructions demonstrate using Microsoft File Explorer to access these files, though other FTP clients may also be used.

Instruction	Image
-------------	-------

Open the FTP client and enter the IP address of the DS4000.	¹ 192/163.13 × + - × × + • New - X ① ① 12/163.13 × · · X ① 12/163.13 × · · X ① ① C ①
Enter "eds" for the user name and "eds" for the password.	Log On As X Image: Second s
The FTP client provides access to the directory that contains the EDS file for EtherNet/IP, the GSD file for PROFINET, and the ESI file for EtherCAT. (e.g., IVEK_DS4000PM_v2_3.eds) and IVEK icon (e.g., Ivek.ico).	¹ 192.168.11 × + - × ¹ New - X C C Starch 192.168.11 · · ¹ New - X C C Starch 192.168.11 · · · Home ·

6. CONNECTING WITH A GATEWAY

For PLCs that do not have an EtherNet/IP, PROFINET, or EtherCAT connection, a gateway (i.e., protocol converter) is necessary to convert the data from one fieldbus to the other (e.g., EtherNet/IP to PROFINET[™]). Also, some PLCs that provide an EtherNet/IP, PROFINET, or EtherCAT interface may provide more of a gateway type of interface, where cyclic data is easy to exchange but exchanging acyclic data is either more complicated or impossible.

When using a device that is only able to translate the data that is exchanged cyclically, it will be necessary to use an alternate interface (e.g., web pages) to modify the non-cyclic parameters. If modification of non-cyclic parameters during runtime is desired in this scenario, then the use of Recipes may be required (Recipes are described in section 7).

Configuring a gateway involves mapping the data bytes through the gateway. To facilitate that configuration, the cyclic data is described in the following table. The DS4000 EDS, GSD, ESI and **Product Manual contain the most up to date data structures and contents of the cyclic data.** Also note that there have been several mappings through the history of the DS4000, so it is important to verify that the map in the gateway matches the map in the device.

EtherNet/IP Producing Data Bytes (Assembly 100) EtherCAT Transmit PDO Mapping PROFINET Module Mapping (Rack 0) (32 bytes total)	Contents	EtherNet/IP Parameter Instance (Assembly 100)	EtherCAT Index	PROFINET Slot
0-3	Status Flags	12	0x200C	8
4-7	Status Flags Extended	13	0x200D	9
8	Status State	14	0x200E	10
9	Reserved	N/A	N/A	11A
10-11	Reserved	N/A	N/A	12
12	Recipe Current	17	0x2011	13
13	Reserved	N/A	N/A	14
14-15	Reserved	N/A	N/A	15
16-19	Fault Code	15	0x200F	16
20-23	Alert Code	16	0x2010	17
24-27	Last Production Volume	91	0x205B	18
28-31	Actual Rate	75	0x204B	19
EtherNet/IP Consuming Data Bytes (Assembly 150) EtheCAT Receive PDO Mapping	Contents	EtherNet/IP Parameter Instance (Assembly 150)	EtherCAT Index	PROFINET Slot

PROFINET Module Mapping (Rack 0)				
(20 bytes total)				
0-3	Command	10	0x200A	1
4-7	Commands Extended	11	0x200B	2
8	Recipe Get	18	0x2012	3
9	Reserved	N/A	N/A	4
10-11	Reserved	N/A	N/A	5
12-15	Dispense Volume	52	0x2034	6
16-19	Rate or Setpoint	76	0x204C	7

7. MODIFYING PARAMETERS USING RECIPES

Recipes provide a way to save the values of parameters together, in order to recall them later. The intention of Recipes is to ease parameter recall when controlling the DS4000 with the HMI, discrete I/O or RS232. However, since some Gateways and PLCs do not lend themselves to acyclic data exchange, recipes may be used to modify parameters during runtime using the cyclic data exchange mechanism. The limitation of this use case is that the recipes must be configured/saved beforehand using one of the non-cyclic parameter interfaces (e.g., web pages, HMI, etc.).

Since the command to recall a recipe (Recipe Get, parameter 18) is available in the cyclic data exchange, it is possible to quickly modify a set of parameters while controlling the DS4000. The DS4000 provides storage in non-volatile memory for up to 32 recipes (identified by numbers 1-32).

Before recalling recipes, it is necessary to first create the recipes in the controller. This is achieved using one of the non-cyclic interfaces (e.g., HMI, web pages, etc.). The method for creating (saving) recipes is as follows:

- 1) Verify that the Recipe Save parameter (parameter 19) is set to 0.
- 2) Modify the parameters to the values desired for the recipe.
- 3) Verify there are no alerts (optional)
- 4) Verify that the Current Recipe (parameter 17) is 0.
- 5) Save the Recipe by setting the Recipe Save parameter (parameter 19) to the desired recipe identification number (1-32).
- 6) Verify that there are no alerts (optional).
- 7) Verify that the Current Recipe (parameter 17) is the desired recipe identification number.
- 8) Set the Recipe Save parameter (parameter 19) back to 0.

The method for recalling (getting) recipes is as follows:

- 1) Recall the recipe by setting the Recipe Get parameter (parameter 18) to the desired recipe identification number (1-32).
- 2) Verify that there are no alerts (optional).
- 3) Verify that the Current Recipe (parameter 17) is the desired recipe identification number.
- 4) Set the Recipe Get parameter (parameter 18) back to 0.

Parameters and Recipe may also be saved to a backup file using the web pages. This backup file may then be restored to other DS4000 controllers to copy the parameters and recipe from one controller to others. Please see Application Note, AN-109, for more information on backing up and restoring DS4000 controller settings.