

Oracle SQL Connection to Sysmac NJ Quick Start Guide

This Quick Start will show you how to connect from the Sysmac NJ to an Oracle SQL database – it will not show you how to set up the database.

Watch the corresponding video on YouTube: Connect Sysmac NJ to Oracle SQL Server http://youtu.be/lkzd6zCVCul

Introduction:

The NJ501 series controllers have three new part numbers—NJ501-1320, NJ501-1420, and NJ501-1520 which have the ability to send data directly to a Microsoft SQL database and an Oracle SQL database. This Quick Start will show you how to connect to a database – it will not show you how to set up the database.

Why the need for database connection?

Assembly lines need an easy and fast way to log or get data on the assembly line for production and product data.

Why direct from PLC?

Assembly lines last up to 10 years. It is very difficult to maintain a SCADA package for 10 years. The computer will not last that long, and it is difficult to find someone to support a 10-year-old version of a SCADA package. Computers take a long time to boot – lost production time.

Computers need updates – IT has to service – no guarantee an update will not adversely affect the performance of the unit.

Why SQL type data bases?

SQL databases accept many connections at once unlike databases like Microsoft Access which only allows one user at a time. Many PLCs can send data at once and many people can get data from the SQL database at once.

Other Features:

The NJ can store the data to a spool file (1Mbyte in NJ memory) if connection to the data base is lost. The NJ can log commands and responses to files on the NJ SD card which come in handy to debug the logging error.

Versions Required:

Sysmac Studio V1.06 with database patch or V1.07.



Example of How to Connect to Oracle SQL

Setup:

In this example my laptop has IP address 192.168.250.40 and has Oracle SQL installed on it. NJ uses address 192.168.250.1

Introduction:

The SQL DB connection is setup in the "Configurations and Setup" in Sysmac Studio.

Show "Host Connection Setting" in the setup section of Sysmac Studio. This lets you test and setup your connection to the SQL Host.

- DB Connection Service Settings specify error files and enable service
- DB Connection Settings set logon to SQL server

Under DB Connection Service Setting – pick "Auto Start" to make the SQL service start on power up. Test mode will send all SQL commands to SD memory card and all the program instructions will assume connect or data transfer was good – for debugging.

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SQL Image: Configurations and Setup Image: CPU/Expansion Racks Image: CPU/Expansion Racks </th <td>DB Connection Service Sex + Image: Service Settings Image: Service Start Auto start (Operation Mode) Auto start (Coperation Mode) Auto start (Test Mode) Do not start automatically Number of files Number of files File size 10 MB When the log is full Stop logging Delete Delete</td> <td></td>	DB Connection Service Sex + Image: Service Settings Image: Service Start Auto start (Operation Mode) Auto start (Coperation Mode) Auto start (Test Mode) Do not start automatically Number of files Number of files File size 10 MB When the log is full Stop logging Delete Delete	
► Programming	▼ SQL Execution Failure Log	
	SQL execution failure log Do not record Record Number of files 5 files File size 10 MB	



Execution Log, Debug Log, and SQL Execution Failure Log all go to the SD card.

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If you right click on "DB Connection" then you can see the Operation Logs – assuming you have a least tried to log on or safe a record. You must be online to see the files.

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An "Operation Log" Window will open. There are three tabs – one for each of the log types. Pressing "Upload" at the bottom of the screen will bring up a list of log files that exist on the SD card.

Microsoft SQL Server V1	🔨 Configurations and Setup 🔟 Q. Q.
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L ► Event Settings Task Settings Gata Trace Settings Get Trace Settings T ■ DB Connection L ■ DB Connection Service Settings T ■ DB Connection Settings L ■ DB Connection Settings L ■ NJEXPRESS Programming	Execution Log × Debug Log × SQL Execution Failure Log × Entry/Date/Time/Category/Log Code/Log Name/Result/Connection Name/Serial ID/
	Details Upload Clear

Select one of the files and press "OK"

S Operation Log		
Name	Size	Updated
DB_ExecutionLog.log	6 KB	27/05/2013 11:27:52 AM
	OK	



The Operation Log is good for seeing when services start and stop.

📓 Operati	ion Log	-						
Executi	on Log 🛛 🗙	Debug Log		×	SQL Exec	cution Failure Log	×	
Entry	Date/Time	Category	Log Code	Log Name	Result	Connection Name	Serial ID	
00000	16/04/2013 02:36:21.714	DB_SERVICE	0001	Start	0x0000			<u>^</u>
00001	17/04/2013 02:39:35.385	DB_SERVICE	0001	Start	0x0000			
00002	17/04/2013 03:47:06.262	DB_SERVICE	0001	Start	0x0000			
00003	17/04/2013 04:50:24.770	DB_SERVICE	0001	Start	0x0000			
00004	17/04/2013 23:28:30.504	DB_SERVICE	0001	Start	0x0000			
00005	17/04/2013 23:28:30.547	DB_SERVICE	0002	Stop	0x0000			
00006	19/04/2013 02:09:19.198	DB_SERVICE	0001	Start	0x0000			
00007	19/04/2013 21:54:22.375	DB_SERVICE	0001	Start	0x0000			
80000	30/04/2013 03:21:53.507	DB_SERVICE	0001	Start	0x0000			
00009	30/04/2013 03:23:10.903	DB_SERVICE	0002	Stop	0x0000			
00010	30/04/2013 03:24:13.399	DB_SERVICE	0001	Start	0x0000			
00011	30/04/2013 05:01:26.905	DB_SERVICE	0002	Stop	0x0000			
00012	30/04/2013 05:02:35.399	DB_SERVICE	0001	Start	0x0000			
00013	30/04/2013 05:03:59.400	DB_SERVICE	0002	Stop	0x0000			
00014	30/04/2013 05:04:45.899	DB_SERVICE	0001	Start	0x0000			
00015	30/04/2013 05:09:32.899	DB_SERVICE	0002	Stop	0x0000			
00016	30/04/2013 05:10:23.900	DB SERVICE	0001	Start	0x0000			\sim
Details								
						Upload		Clear

The operation log shows when the database commands occurred – good for the line programmer.

5	Operati	on Log								x
	Executi	on Log	×	Debug Log		×	SQL Exe	cution Failure Log	×	
	Entry	Date	e/Time	Category	Log Code	Log Name	Result	Connection Name	Serial ID	
	00000	10/05/2013	04:40:21.393	SQL	0001	INSERT	0x0000	NJEXPRESS	000000002	
1	00001	10/05/2013	04:40:21.435	SQL_RESULT	0001	INSERT	0x0000	NJEXPRESS	000000002	
	00002	10/05/2013	04:51:21.077	SQL	0001	INSERT	0x0000	NJEXPRESS	000000003	
	00003	10/05/2013	04:51:21.110	SQL_RESULT	0001	INSERT	0x0000	NJEXPRESS	000000003	
De	_{tails} TA	BLE3 Insert	1_Data i	nsert into TAB	le3 ("QTY	") values(0)				
								Upload	C	ear

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The SQL Execution Failure Log shows the "to and "from" SQL commands – good for IT and high level NJ/SQL programmer. These logs are good for showing why a log did not happen – i.e., empty field on a field that cannot be empty.

How to create the connection profile:

Go to "DB Connection Settings – Right Click – "Add" – "DB Connection Settings". This will create a new connection setting – in this case "NJEXPRESS" is what I labeled this connection setting – "Connection Name". Database Type: SQL Server for Microsoft SQL and Oracle for Oracle SQL. Server Specification Method: IP address or Host name of the computer the SQL server is on. Instance Name/Port Number: 1433 is the default. You do not need to specify if it is the default.

Service Name/Database Name: You must enter the database name here as specified by IT people. You can omit the name if the user has been set by default to the correct Service/Database within SQL.

You must then enter the Login Name and Password as given by IT people.

SQL Server Oracle V3	🔧 Configura	ations and Setup		
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Configurations and Setup D D D D D D	402	Connection Set	ttings	
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🗆 🗆 🖌 Cam Data Settings		Server specification method	IP address Host nam	ie
🔳 💷 🏲 Event Settings		IP address	192.168.25040	
🗆 🖿 Task Settings		Host name		
Data Trace Settings		Instance name/Port No.		(Can be omitted)
▼ L Host Connection Settings		Service name/Database name	NJOracle1	(Can be omitted)
DB Connection DB Connection Service Settings		Userame	LN I	
▼ → DB Connection Settings		Fassword	**	
t → Oracle9		Password (for confirmation)	**	
Oracle11		Login timeout	20 s	
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You can now press the Communications Test Button. "Test OK" will show if connection was successful.

In this case the controller was not connected to the SQL server so an error message is shown.

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SQL 🔻	NJEXPRES	is 🗙 🕂		
Configurations and Setup	402	Connection Set	tings	
CPU/Expansion Racks		▼ DB Connection		
► ∰ Controller Setup ► ∰ Motion Control Setup	r•∎•	Connection name Database type	NJEXPRESS SQL Server	
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🗆 🖿 Task Settings		Host name		
Left Data Trace Settings		Instance name/Port No.	1032	(Can be omitted)
B DB Connection		Service name/Database name	NJEXPRESS	(Can be omitted)
DB Connection Service Settings		User name	LIA	
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rer l		▼ DB Communications Test		
		Communications Test	Communications Test	
			Response timeout has occurred. Check for the connection of the c	communications cable.

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Ladder Code to send data to SQL:

You have created a connection setup log into the SQL data base and tested it. Now we want to add ladder code to send data to/from the SQL server. There is 3 basic parts to this step:

- 1) DB_Connect and DB_Close instructions to log in and log out of the SQL the database.
- 2) A DB_CreateMapping instruction to create a map between NJ Tags and SQL fields/Table.
- 3) DB_Insert/Select/Delete/Update instructions.
 - Insert: to append data to the table
 - Select: which allows you to query data from the table
 - Delete: delete a record.
 - Update: modify a record.

This is an example of how to write the connection program:

The _DBC_Status.Run bit lets you know the DB service has actually started up and is running.

'NJEXPRESS' with single quotes is how you specify the DB Connection you want to connect use. The "Done" bit lets you know if you successfully connected to the database/table.

The SQL_DBConnection variable is the reference variable to this database connection for all the other instructions including SQL_Close.

It is a good idea to close the database when the controller is about to shut down.





atabase Instanc	e: NJOracle1 > <u>Tables</u> >						L	ogged in As
					Act	ions Create Like	G0	Edit
General								
Columns		Scher Tablespa Organizati	na NJ ce USERS on Standard	(Heap Organized)				
Columns	Name	Scher Tablespa Organizati Data Type	na NJ ce USERS on Standard	(Heap Organized) Scale	Not NULL	Default Value	E	ncrypted
Columns	Name QTY	Scher Tablespa Organizati Data Type NUMBER	a NJ e USERS on Standard Size	(Heap Organized)	Not NULL	Default Value	E	ncrypted
Columns	Name QTY BARCODE	Scher Tablespa Organizati Data Type NUMBER VARCHAR2	a NJ ce USERS on Standard Size 40	(Heap Organized)	Not NULL	Default Value	E	incrypted

Indicates a SecureFile LOB column

The next step is to map the NJ Tags to the Database Tables Fields

DBConnection: This came from the "DB_Connect Instruction" – unique number identifier for each connection. TableName: This is the name of the Table you want to send data to/from in the SQL server. SQLType: Enter one of the following constants: DBC_SQLTYPE_INSERT, DBC_SQLTYPE_SELECT, DBC SQLTYPE DELETE, DBC SQLTYPE UPDATE.

You must enter a unique variable name for "MapVar" even if it is for the same table - or only the last one will work. The MapVar must be of a structure type. Here is an example of an NJ Structure and the SQL table. In this case under Table4 of Database NJEXPRESS you will see Barcode, Qty, and Timestamp. The SQL_Insert_Type is exactly the same. The member names must match exactly the field names in the SQL database. You do not have to have all the field names - nor do they have to be in order. The variable types will not match exactly and the manual shows you how to match them up. I have included most of the table below.

The "done" output in the DB Mapping means nothing. No data transfer occurs with the SQL database. It does not mean the mapping was good.



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	I Name	I Base Type	I Offset Type
	Oracle9_NJTABLE_Type	STRUCT	NJ
·	TIMESTAMP	DATE_AND_TIME	
	BARCODE	STRING[41]	
	DATA1	DINT	
V	Oracle9_NJTABLE1_Type	STRUCT	NJ
	BARCODE	STRING[41]	
	DATA1	BINT	
	Oracle11_NJTable1_Type	STRUCT 🧹	NJ
	QTY	DINT	~
	BARCODE	STRING[41]	-
	TIMESTAMP	DATE_AND_TIME	

ORACLE En Database Contro	terprise Manager 11 <i>g</i> 📕						Setup Preferences Help Logout Database
Database Instance	NJOracle1 > Tables >						Logged in As S
view Table: N	IJ.NJTABLET				Acti	ions Create Like	Go Edit O
General							
Columns		Nam Schem Tablespac Organizatio	e NJTABLE1 a NJ e USERS n Standard	(Heap Organized)			
Columna	Vanie	Data Type	Cize	Scale	Not NULL	Default Value	Encrypted
	QTY	NUMBER					
(BARCODE	VARCHAR2	40)			
	TIMESTAMP	DATE	/				
♥ Indicates a	Primary Key commu						

✓ Indicates a Unique Key column ■Indicates a SecureFile LOB column



	Data Type		
Data Type	specified in IEC	Oracle	SQL Server
	61131		
Declass / hit string	DOOL		h.:4
Boolean / bit string	BOOL	NUMBER(1)	DIT
	BYTE	RAW	varbinary
		D 414/	
	WORD	RAW	varbinary
	DWORD	RAW	varbinary
	LWORD	RAW	varbinary
Signed integers	SINT	NUMBER(3)	tinyint
	INT	NUMBER(5)	smallint
	DINT	NUMBER(10)	int
	LINT	NUMBER(20)	bigint
Unsigned integers	USINT	NUMBER(3)	smallint
		NUMBER(5)	int
			-
	UDINT	NUMBER(10)	bigint
	ULINT	NUMBER(20)	decimal
Real	REAL		real
		BINARY_FLOAT	
		NUMBER	float
		BINARY_DOUBLE	nout
Time of day,	TIME	TIMESTAMP	time
duration, date			
	DATE	TIMESTAMP	date
	TIME_OF_DATE	TIMESTAMP	time
	DATE_AND_TIME	TIMESTAMP	datetime
Taut atria		VARCHAR2	varchar
i ext string	SIRING	NVARCHAR2 <a03></a03>	nvarchar

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To Insert Data into the SQL database:

The DB_Insert instruction needs two reference inputs:

- DB_Connection comes from the DB_Connect instruction.
- MapVar is the same variable we used in the DB_CreateMapping instruction.
- With these two pieces of information the insert instruction know which database, table, and fields to add the data too.
- The "done" output does tell you if the data was successfully sent to the SQL database.

▶ @ Motion Control Setup						
■ ⊢ & Cam Data Settings	mals Name	I Data Type	Initial Value	AT	l Retain	Constant
External Ext	mals DB2_Connected	BOOL				
💷 🗉 Task Settings	QTY	DINT		1		
📰 💷 🔤 Data Trace Settings	User Man	ROOL				
Host Connection Settings	DB2Insert1	Oracle11 NITable1 Type				
▼	DR2 NULARIEL RUSS	Content of the content of the				
DB Connection Service Settings		BOOL				
▼ In DB Connection Settings	DB2_NJTABLEI_ERROR	BOOL				
□ Im Oracle9	DB2_NJTABLE1_ERRORID	WORD		_		
		WORD				
▼ Programming 0	DB2 Connected	DB_INSERTI_MAP		D	B2 INSERT1	MAP OK
▼ @ POUs		Execute Done			<u> </u>	1575
▼ (ii) Programs	D82.02	Anastics OF Connection Runi DP3 NITARIES	PLIEV		0	
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Simulation_Data		IJTABLE1' TableName Error DB2_NJTABLE1	ERROR			
Anna Data NITARIE	D	B2Insert1-MayVar ErrorID-DB2 NJTABLE1	ERRORID			
Insert Data NITABLE						
ि Select Data NITABLE	DB_SQUIYP	E_INSERT-PQLType				
An Data NITABLE		DB2 SELECT1 MAP				
Insert Data NITABIE1	DB2_Connected	DB_CreateMapping		D	B2_SELECT1	MAP_OK
Select Data NJTABLE1		Execute Done			0	
▼ III Oracle 11	DB2 Co	onnection DBConnection Busy DB2 SELECT1 I	MAP BUSY			
🗆 🗟 Simulation_Data		1	-			
L 信 Connect	'N	IJTABLE1' TableName Error DB2_SELECT1_I	MAP_ERROR			
Map_Data	DE	B2Select1-MapVar ErrorID-DB2_SELECT1_I	MAP_ERRORID			
∟ 🗟 Insert_Data						
🗆 📇 Select_Data	_DB_SQLITP	L'accord addribbe				
E Functions	1					1

To Select Data from the database:

The DB_Select instruction does this for us. It works mostly the same as DB_Insert with two major differences. The MapVar can be an array. (Notice there is not "[0]" at the end of the variable name when it is an array. There is a "Where" input to filter which records you are looking for. (There is also a sort input). There are two counters at the bottom right corner of the instruction to tell you how many records it found and how many it gave to you (if your array was too small it just gives you enough to fill the array.) Notes on how to use the "Where" are below.



▶ ⓓ Motion Control Setup		space - Using				
🖉 🖉 Cam Data Settings	Internals	Name	i Data Type	Initial Value	AT Retain	Constar
Event Settings	Externals	User_Select1	BOOL			
🔲 🗆 崎 Task Settings		DB2 SELECT1 MAP	DB CreateMapping			
🔲 🗆 🗺 Data Trace Settings		DB2Select1	ARRAY[0, 19] of Oracle11 NITable1 Type			
🔻 🚛 Host Connection Settings	and the second	DR SOLTVDE INSERT	AUR STUTYDE	DRC SOLTYP		
🗰 🔻 🥅 DB Connection						
DB Connection Service Settings		_DB_SQLTYPE_SELECT	_eDBC_SQLITPE	_DBC_SQLIYP		
DB Connection Settings		DB2_SELECT1_BUSY	BOOL			
💷 👾 Oracle9	- e	DB2_SELECT1_ERROR	BOOL			
Oracle11						
▼ Programming	O Ye	ou must put something in the	select "Where" variable or you get error 300E			
🔻 👩 POUs		P_First_RunMode	1 Oracle11 Where:='OTY=1':			
▼ [#] Programs						
▼ 🔤 Oracle_9						
🗉 🖪 Simulation_Data						
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L de Map_Data_NJTABLE						
Insert_Data_NJTABLE						
Select_Data_NJTABLE	1		DB2 SELECT1			1
Map_Data_NJTABLE1		User_Select1 DB2_SELECT1_	MAP_OK DB_Select		DB2_SELECT	1_DONE
Insert_Data_NJTABLE1		-	Execute	Done	0	
Select_Data_NJTABLE1			DB2 Connection	BUSY-DB2 SELECT1 BUSY		
▼ 💀 Oracle_11						
🗆 🖶 Simulation_Data			Oracle11_Where—Watre	Error DB2_SELECT1_ERROR		
∟ de Connect			Enter Variable—Sort E	rrorID - DB2_SELECT1_ERRORID		
🗆 🖾 Map_Data						
L 를 Insert_Data			Enter Variable TimeOut R	ecunt-DB2_SELECT1_RECONT		
🗖 💷 🐺 Select_Data			DB2Select1-NapVar Selecte	edCnt DB2_SELECT1_SelectedC	Int	
⊢ 😹 Functions						
Image: Big						

Both SQL and Sysmac Studio use ' ' in their syntax. To let Sysmac Studio the ' is for Oracle put a \$'. So the following first example means: BARCODE LIKE 'B%' to Oracle. The % is a wildcard to Oracle when the "LIKE" is included.

_	1 □ F selection1=0 THEN
	2 Oracle9_NJTABLE1_Select_Statement:='BARCODE LIKE \$'B%\$'';
	3 END_IF;
	4 ⊡IF selection1=1 THEN
	5 Oracle9_NJTABLE1_Select_Statement:='BARCODE=\$'B0\$'';
	6 END_IF;
	7 □IF selection1=2 THEN
	8 Oracle9_NJTABLE1_Select_Statement:='DATA1=1';
	9 END_IF;
	10

Here is an example of the Select type Variable for the answer – notice how it is an array so we can accept more than one record from the select query.

This completes the Quick Start for the Connect Sysmac NJ to an Oracle SQL Database

Please visit our YouTube Channel for Omron Quick Tip and other videos: https://www.youtube.com/user/OmronAutomationTech

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