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CNC interface documentation

Industry 4.0 ready



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1.0 INTRODUCTION

1.1 INDUSTRY 4.0

Industry 4.0 allows the integration of new production technologies to improve working conditions, increase productivity and the production quality of the plants.

Touch Command EVO 4.0 saves in a "DataBase" all the machine information in real time and allows the sharing of data to the external user.

In this chapter we will try to simplify the understanding of some concepts, which will be explained in the following chapters

1.2 GENERAL INFORMATION

The **RDBMS** (Relational DataBase Management System) **MySQL** is running on the CNC; this interfaces with the **ODBC** (Open DataBase Connectivity) for managing the **DB** (DataBase) called "mysql".

The **Touch Command Evo 4.0** Software updates the **DB** in real time by writing, in the various tables which compose it, all the production processes and alarm signals that the machine provides.

The standardized language for databases based on the **RDBMS** relational model is called **SQL** (Structured Query Language). It allows the reading / writing of the information saved by the CNC at any time.

Through queries it is possible to ask for the **DB**, asking for the desired information (example: yes, I want to see the production queue). The **RDBMS** will answer with a table containing the required records. The viewer used by the user will show the data (see chapter 3.0).

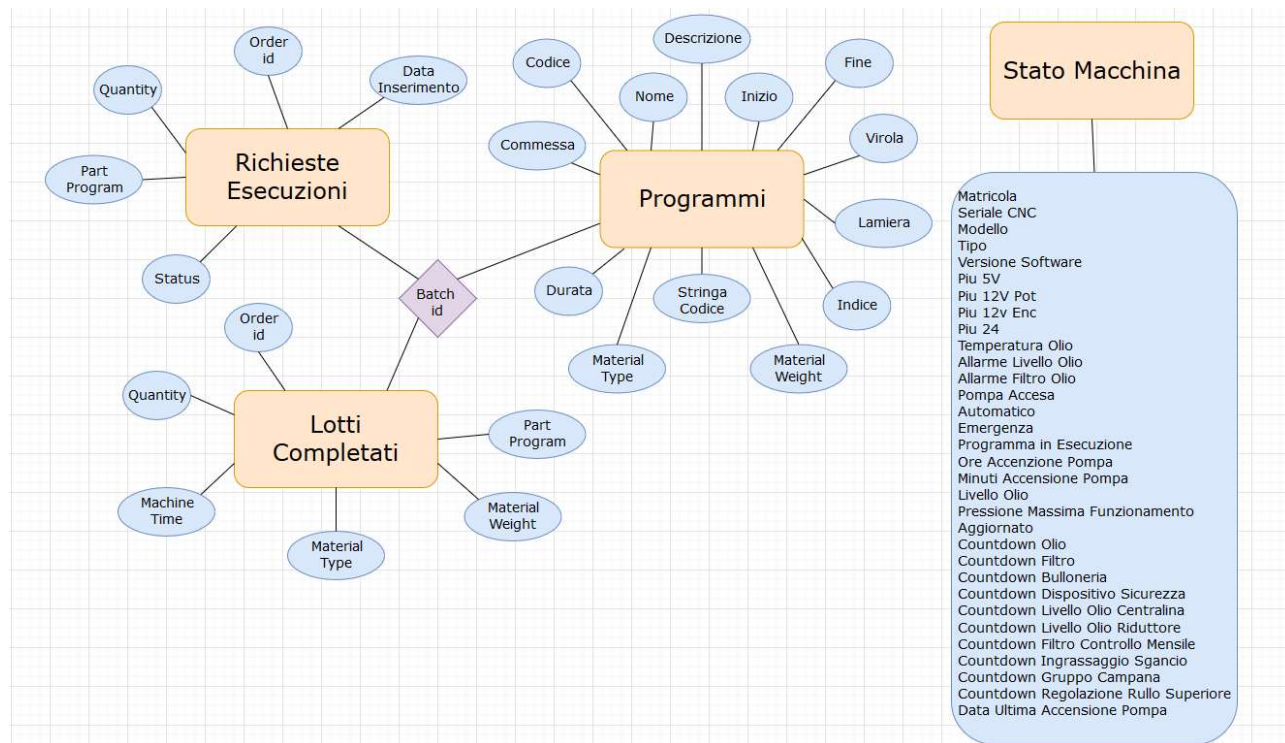


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2.0 DATABASE STRUCTURE

2.1 TABLES DATABASE STRUCTURE



2.2 DETAILS OF DATABASE TABLES

richieste_esecuzione (*requests_execution Input data*)

Field	Type	Null	Key	Default	Extra
batch_id	varchar(128)	NO	PRI	NULL	
part_program	varchar(128)	NO		NULL	
quantity	int(11)	NO		NULL	
order_id	varchar(128)	NO		NULL	
status	int(1)	NO		0	
data_inserimento	timestamp	NO		current timestamp	

This table is used to send production orders to the machine.



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Sequence:

- a) The production order is entered (at any time) at the end of the table with the respective quantities to be produced.
- b) The current list of production orders is updated in real time and can be viewed (at any time) by the operator.
- c) The operator selects the batch to be produced.
- d) The program associated with the part_program is automatically loaded and the pieces counter is initialized
- e) The operator carries out the production.
- f) The operator, once the quantity is reached, establishes that the batch is complete; removes the order from the queue; at this point the order is inserted in the completed batch table.

Below the description of the fields:

- 1) **batch_id**: Unique identifier of the lot. Unique means used once and only once.
- 2) **part_program**: Identification of the detail to be created, as recorded on the company database and on the various documents. On the CNC there must be an association between this name and the name of the program. With program we mean the sequence of instructions to be executed.
- 3) **quantity**: Quantity of pieces to be produced.
- 4) **order_id**: job identification.
- 5) **status**: Program identification in the execution phase (0 = program appended, 1 = program running).
- 6) **data_inserimento**: date batch entry in appending to the production list (this field is automatically entered by the Database).

lotti_completati (*Completed_batches Output data*)

Field	Type	Null	Key	Default	Extra
batch_id	varchar(128)	NO	PRI	NULL	
part_program	varchar(128)	NO		NULL	
quantity	int(11)	NO		NULL	
order_id	varchar(128)	NO		NULL	
material_type	varchar(128)	NO			
material_weight	decimal(8,3)	NO		0.000	
machine_time	int(11)	NO		0	

Below the description of the fields:

- 1) **batch_id**: Unique identifier of the batch. Unique means used once and only once.
- 2) **part_program**: Identification of the detail to be created, as recorded on the company database, and on the various documents. On the CNC there must be an association between this name and the name of the program. By program we mean the sequence of instructions to be executed.
- 3) **quantity**: Quantity of pieces to be produced.
- 4) **order_id**: Order ID.

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5) **material_type**: material ID

6) **material_weight**: Sum of the total weight ID for all the pieces produced for that batch id (it is calculated automatically).

7) **machine_time**: ID of the time taken for the production of a batch; the duration of all the executed programs of the completed batch_id is added (it is calculated automatically).

Programmi (Programs data in program execution phase)

Field	Type	Null	Key	Default	Extra
indice	int(128)	NO	PRI	NULL	Auto incremental
codice	varchar(50)	YES		0	
nome	varchar(50)	YES		NULL	
descrizione	varchar(200)	YES		NULL	
lamiera	varchar(200)	YES		NULL	
virola	varchar(200)	YES		NULL	
inizio	timestamp	NO		CURRENT_TIMESTAMP	
fine	timestamp	NO		0000-00-00 00:00:00	
durata	int(11)	YES		0	
stringa_codice	varchar(128)	YES		NULL	
batch_id	varchar(128)	YES		NULL	External key
commessa	varchar(128)	YES		NULL	
material_type	varchar(128)	NO		NULL	
material_weight	decimal(8,3)	NO		NULL	

This table is updated every time any program is run: every time a (complete) program is executed, a record is generated on the database. The user can extract the cumulative information he needs by reading the database (chapter 3.0).

Below the description of the fields:

- 1) **indice**: Primary key of the database.
- 2) **codice**: Numerical code associated with the program.
- 3) **nome**: Program name registered on the CNC; with program we mean the sequence of movements to produce a single piece.
- 4) **descrizione**: Short description of the program. This information is entered, if desired, by the operator, with an unspecified use.
- 5) **lamiera**: Name of the file on the CNC with information on the type and size of the material used to produce the part.
- 6) **virola**: Name of the file on the CNC with information on the size and shape of the part.
- 7) **inizio**: Real start of the running program.
- 8) **fine**: Real end of the program just performed.
- 9) **durata**: Time calculated in seconds for the program duration.
- 10) **stringa_codice**: String that identifies the item to be produced as recorded in company database and various documents. Generally, it is different from the program name; "program" means the sequence of instructions stored on the CNC.

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11) **batch_id**: Unique identifier of the batch for which the program was executed.

12) **commessa**: Job identification (the field is entered automatically).

13) **material_type**: Material ID (the field is entered automatically).

14) **material_weight**: Weight ID (the field is entered automatically).

stato_macchina (machine_status Output data)

Field	Type	Null	Key	Default	Extra
Matricola	varchar(30)	YES		0	
SerialeCNC	int(11)	YES		0	
Modello	varchar(30)	YES		MH	
Tipo	varchar(30)	YES		4rolls Bending Machine	
VersioneSoftware	varchar(30)	YES		0.0.0	
Piu5V	tinyint(1)	YES		0	
Piu12VPot	tinyint(1)	YES		0	
Piu12VEnc	tinyint(1)	YES		0	
Piu24V	tinyint(1)	YES		0	
TemperaturaOlio	decimal(3,1)	YES		NULL	
AllarmeLivelloOlio	tinyint(1)	YES		0	
AllarmeFiltroOlio	tinyint(1)	YES		0	
PompaAccesa	tinyint(1)	YES		0	
Automatico	tinyint(1)	YES		0	
Emergenza	tinyint(1)	YES		0	
ProgrammaInEsecuzione	tinyint(1)	YES		0	
OreAccensionePompa	int(11)	YES		0	
MinutiAccensionePompa	int(11)	YES		0	
LivelloOlio	int(11)	YES		100	
PressioneMassimaFunzionamento	int(11)	YES		0	
Aggiornato	timestamp	NO		CURRENT_TIMESTAMP	on update CURRENT_TIMESTAMP
CountdownOlio	int(11)	YES		60000	
CountdownFiltro	int(11)	YES		60000	
CountdownBulloneria	int(11)	YES		48000	
CountdownDispositivisicurezza	int(11)	YES		20	
CountdownLivelloOlioCentralina	int(11)	YES		20	
CountdownLivelloOlioRiduttore	int(11)	YES		20	
CountdownFiltroControlloMensile	int(11)	YES		20	
CountdownIngrassaggioSgancio	int(11)	YES		5	
CountdownGruppoCampana	int(11)	YES		260	
CountdownRegolazioneRulloSuperiore	int(11)	YES		5	
DataUltimaAccensionePompa	date	YES		NULL	

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This table contains the machine identification data, alarm status, operating mode, and maintenance status. These data can also be consulted via the WEB interface (see chapter 3.0). The maintenance status can also be consulted directly on the CNC.

Below the description of the fields:

- 1) **matricola**: Machine Serial Number.
- 2) **serialeCNC**: Serial number of the CNC.
- 3) **modello**: CNC model.
- 4) **tipe**: machine type
- 5) **VersioneSoftware**: Version of the software.
- 6) **Piu5v**: 5VDC Power (where expected).
- 7) **Piu12VPot**: 12VDC Potentiometer Power (where expected).
- 8) **Piu12VEnc**: 12VDC Encoder Power (where expected).
- 9) **Piu24V**: 24VDC Power (where expected).
- 10) **TemperaturaOlio**: Value for Oil Temperature.
- 11) **AllarmeLivelloOlio**: Value for oil level alarm.
- 12) **AllarmeFiltroOlio**: Value for dirty oil filter.
- 13) **Pompaaccesa**: signal pump ON.
- 14) **Automatico**: Value for machine in Automatic Status.
- 15) **Emergenza**: Value per machine in Emergency Status.
- 16) **ProgrammaInEsecuzione**: signal program in execution.
- 17) **OreAccensionePompa**: value hours for pump running.
- 18) **MinutiAccensionePompa**: value minutes for pump running.
- 19) **LivelloOlio**: value for Oil Level
- 20) **PressioneMassimaFunzionamento**: value for maximum working pressure .
- 21) **Aggiornato**: time status updated.
- 22) **CountdownOlio**: Oil counter.
- 23) **CountdownFiltro**: Counter oil filter.
- 24) **CountdownBulloneria**: Counter bearings.
- 25) **CountdownDispositiviSicurezza**: Counter Safety devices.
- 26) **CountdownLivelloOlioCentralina**: Counter for oil level.
- 27) **CountdownLivelloOlioRiduttore**: Counter for oil level riducer.
- 28) **CountdownFiltroControlloMensile**: Counter for oil filter.
- 29) **CountdownIngrassaggioSgancio**: Counter for yoke greasing.
- 30) **CountdownGruppoCampana**: Counter for Bearing.
- 31) **CountdownRegolazioneRulloSuperiore**: Counter for top roll adjustment.
- 32) **DataUltimaAccensionePompa**: Date for last pump ON.



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3.0 DATABASE CONNECTION

3.1 DATABASE CONNECTION TOOLS

The user has the possibility to connect and view the data at any time of the day, in two different methods:

- 1) Using a free downloadable software (such as MySQL Workbench <https://www.mysql.com/products/workbench/>) which allows the execution of SQL queries.
- 2) By using any web browser (e.g. Internet Explorer, Mozilla Firefox, Google Chrome, Opera, Safari).

First of all, you need to enter a static IP address on the CNC of the machine (consult your network systems engineer before entering one)

Then, in the first case (once the software is installed) it is necessary to log into the database using the following credentials to access the MySQL server:

Indirizzo IP Macchina: xxx.xxx.xxx.xxx

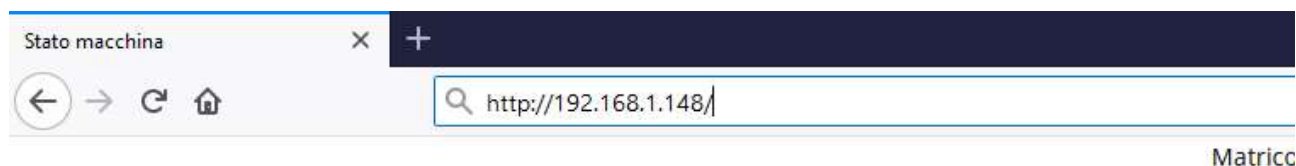
user: root

password: salamov

Once connected, you can run Database query queries to read the requested information.

In the second case, on the other hand, just open the web browser on a PC (it must also be in the same network as the CNC), type in the top bar http: // followed by the IP address of the machine.

Automatically, the information on the machine status will appear as the first page. It will also be possible to view the production queue and the programs executed.

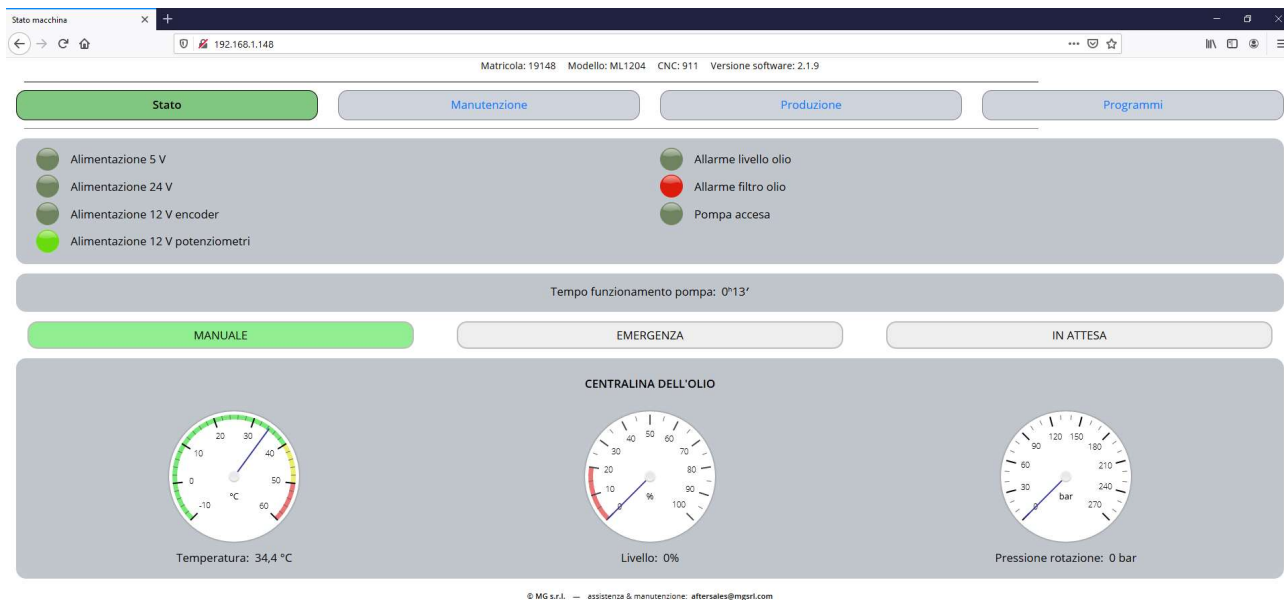




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Status Machine



Maintenance

Matricola: 19148 Modello: ML1204 CNC: 911 Versione software: 2.1.9				
Stato Manutenzione Produzione Programmi				
N	Intervento	Frequenza	Reset	Modalità
1	Integrità ripari fissi	Verifica giornaliera integrità ripari (nel caso risultino danneggiati o rimossi non utilizzare la macchina)		Tutti i ripari devono essere al loro posto e correttamente fissati. Le relative targhe di avvertimento non devono essere state rimosse. Inoltre verificare: usura delle giunzioni o dei punti di fissaggio, perdita o danneggiamento di parti del riparo, mantenimento delle distanze di sicurezza e delle dimensioni di apertura originali.
2	Integrità azionamenti	Verifica giornaliera integrità azionamenti (nel caso risultino danneggiati non utilizzare la macchina)		Tutti gli azionamenti devono essere integri. Le relative targhe di indicazione devono essere leggibili.
3	Integrità rulli	Verifica giornaliera integrità rulli (nel caso risultino danneggiati non utilizzare la macchina)		I rulli non devono presentare alcuna anomalia sulla totalità della superficie.
4	Integrità dispositivi di sicurezza	Verifica giornaliera integrità dei seguenti dispositivi: • pulsante di arresto di emergenza • fune di sicurezza • interruttore blocco porta quadro elettrico principale (nel caso risultino danneggiati non utilizzare la macchina)		I Dispositivi di sicurezza devono essere assolutamente integri e le relative targhe di indicazione leggibili. Provvedere all'attivazione del dispositivo per la verifica dell'efficacia. Il ripristino dovrà avvenire secondo le modalità riportate nel paragrafo del manuale di uso e manutenzione.
5	Lubrificazione sgancio	Verifica giornaliera della lubrificazione dello sgancio; nel caso in cui le parti soggette a scorrimento siano prive di lubrificante, contattare il servizio manutentivo		L'addetto macchina ha il compito di verificare la lubrificazione delle parti a scorrimento; non eseguire la lubrificazione in quanto tale attività è riservata al servizio manutentivo.
6	Verifica assenza perdite olio idraulico	Verifica giornaliera dell'assenza di perdite olio idraulico sia dalla centralina idraulica che dalle condotte di alimentazione degli organi attuatori (nel caso vi siano delle perdite non utilizzare la macchina e contattare il servizio manutentivo)		L'addetto macchina ha il compito di verificare l'assenza di perdite; non eseguire alcun intervento di riparazione in quanto tale attività è riservata al servizio manutentivo.
8	Serraggio Viti	Controllare il serraggio delle viti fra 800 ore	Azzera	Provvedere al serraggio mediante appositi strumenti atti al fissaggio.
9	Centralina idraulica	Sostituzione dell'olio fra 1000 ore	Azzera	Sostituire l'olio ogni 1000 ore di lavoro.
10	Filtro olio	Sostituzione filtro fra 1000 ore .	Azzera	Sostituire per la prima volta il filtro olio dopo 800 ore funzionamento. Successivamente ogni 1000 ore

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Production

Matricola: 19148 Modello: ML1204 CNC: 911 Versione software: 2.1.9

Stato	Manutenzione	Produzione	Programmi

Programmi executed

Manutenzione

Produzione

Programmi

Nome	Codice	Descrizione	Inizio	Fine	Durata	Virola	Lamiera
Senza nome	0	empty	2019-11-08 15:54:29	2019-11-08 15:55:04	35	empty	empty
Senza nome	0	empty	2019-11-08 15:48:21	2019-11-08 15:48:29	8	empty	empty
Senza nome	0	empty	2019-11-08 15:47:14	2019-11-08 15:47:28	14	empty	empty
Senza nome	0	empty	2019-10-29 18:10:59	2019-10-29 18:11:53	54	empty	empty

4.0 REMOTE ASSISTANCE

4.1 REMOTE ASSISTANCE TOOLS

- 1) An SSH server is working on the CNC and running to the port 22. It is necessary to create a rule on the company router to be able to access this port from outside.
- 2) A VNC server is working on the CNC and running to the port 5900. It is necessary to create a rule on the company router to be able to access this port from outside.
- 3) A client is working on the CNC for the management of any software crashes: this client automatically connects to our server and sends the core dump for off-line analysis.
- 4) A server web is working on the CNC and running to the port 80, which offers a WEB interface to the database tables and allows to enter the production orders without using additional software. We usually connect by TeamViewer or similar to a desktop computer on the same local network as the CNC, without further complications related to port re-direction, and from this to the CNC.

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