CKD

スカラロボット
KSL シリーズ
（TP5100 操作マニュアル）

取扱説明書

SM-A78392

- 製品をご使用になる前に、本取扱説明書を必ずお読みください。
- 特に安全に関する記述は、注意深くお読みください。
- 本取扱説明書は必要なときにすぐ取出して読めるように、大切に保管してください。

CKD株式会社

この取扱説明書に対応しているコントローラは KSL3000 シリーズです。

はじめに

このたびは弊社のロボットシステムをお求めいただきましてありがとうございます。
本マニュアルは、ティーチペンダント TP5100 について、既存の TP1000 の取扱説明書 SM-A20049　操作マニュアルを保有されていることを前提に、TP1000 と操作・表示が異なる部分のみ記載しています。
操作手順が同じものについては TP1000 の取扱説明書 SM-A20049　操作マニュアルを参照してください。

本マニュアルの構成は、次の通りです。

第 1 編：基本編
TP5100 の操作における基本的な事項について説明します。

第 2 編：機能編
TP5100 で追加・変更された機能について説明します。

目次

使用範囲について

ワークの移動，整列といった搬送作業、部品の挿入，ねじ締めといった組立作業など、幅広い作業の自動化に適応することを意図して開発されました。
お客様におかれましても、これらの作業の自動化適応や自動化機器への組込みを目的とした使用をお願い致します。

人に接触する作業（医療，介護に関する作業など）への適用，人の生命を維持する機器（生命維持装置，保育器など）への組込み，人が搭乗する機器（車などの輸送機器，飛行機などの航空宇宙機器，ジェットコースターなどの遊戯機器）への組込み，人命や人体を保護する機器（安全装置など）への組込みなどは、意図しておりません。
高い熱量を制御することを目的とした機器（原子力制御機器，燃焼炉制御機器など）への組込みなどは、意図しておりません。
故障や誤作動により、直接人の生命を脅かし、人体に危害を及ぼす恐れのある作業への適用や機器への組込みには、本製品の使用を禁じます。使用された場合、お客様の責任で保証されることとなります。

使用方法について

　TP5100 の使用条件について説明します。条件と異なった状態で使用すると、想定外のリスクが生じる可能性があります。条件を守ってご使用ください。

　1.製品の主な仕様　ご使用のロボットを対象としたロボットマニュアルまたは据付・輸送編を参照してください。

　2.使用上の制限　　表 1 から表 6 に、使用上の制限を示した「制限仕様シート」を掲載します。

表 1　制限仕様シート

1.製品を使用する目的と用途（使用上の制限）	
1) 意図する 使用	目的（物品の搬送,組立,検査,加工等）に沿った動作をロボットに実現させる (1)輸送 ①開梱場所までの輸送ルートを確保する ②フォークリフト等により梱包箱を持ち上げる ③梱包箱を開梱場所へ移動する (2)開梱 ①開梱に必要なスペースを確保する ②荷紐を切断して開梱する ③ロボットを固定している荷紐を切断する ④コントローラの梱包箱のテープを剥がして開梱する ⑤ロボットやコントローラの破損がないことを確認する ⑥付属品と、その数量を確認する ・ロボットを据付場所へ運搬する場合 ⑦梱包資材の廃棄、または保管と管理をする ・ロボットを保管する場合 ⑦納入時のように固定をして、再梱包する ⑧梱包箱を保管場所へ移動する (3)運搬 ・ロボット ①ロボット運搬時の姿勢を確認する ②ロボット固定治具が取り付けられていることを確認する ③クレーンを使用する場合は、付属のアイボルトを取り付ける ④ロボット固定治具の固定ボルトの締まりを確認する ⑤クレーンや台車を用いて据付場所へ運搬する ・コントローラ ①　台車を用いて据付場所へ運搬する

表 1　制限仕様シート(続き)

1.製品を使用する目的と用途（使用上の制限）	
1) 意図する 使用 (続き)	(4)据付 ①ロボットを架台等にボルトで固定する ②必要なケーブルを作成する ③ロボット固定治具とアイボルトを取り外す

④コントローラを設置し、ロボットと接続する

⑤ロボットを手で押して、作業しやすい場所へ動かす

⑥エンドエフェクタを取り付ける

⑦必要な外部機器と接続する

(5)教示

①ティーチペンダント等による誘導や手で押すなどして、任意の位置や姿勢になるように
ロボットを動かす

②ロボットが動作する位置を教示する

③動作順序（プログラム等）を作成する

④外部機器との間の信号やデータの授受を確認する

⑤低速（250mm/sec 以下）で動作確認する

⑥徐々に運転速度を上げながら、目的に沿った動作であることを確認する

（6）運転

①ロボットの運転を開始する

②所定の速度で、目的に沿った動作をしていることを確認する

③ロボットの運転を停止する

（7）再梱包

①エンドエフェクタを取り外す

②ティーチペンダント等による誘導や手で押すなどして、固定治具が取り付けられる位置
や姿勢になるようにロボットを動かす

③固定治具を取り付ける

④電源を切り、配線を外す

⑤梱包に必要なスペースを確保する

⑥クレーンを使用してロボットを運搬する場合は、付属のアイボルトを取り付ける

⑦ロボットとコントローラを梱包場所へ運搬する

⑧ロボットとコントローラを納入時のように梱包する

⑨輸送機器（トラック等）までの輸送ルートを確保する

⑩梱包箱をフォークリフトで持ち上げる

⑪梱包箱を輸送機器へ載せる

表 1　制限仕様シート(続き)

1.製品を使用する目的と用途（使用上の制限）	
1) 意図する 使用 （続き）	（8）保守 【１次電源オフの状態で実施する作業】 ・ロボット ①ボルトの緩みやガタツキの確認と増し締め実施 ②ケーブルクランプに緩みがないことの確認 ③キズの有無の点検 ④ゴミの清掃 ⑤防錆剤の点検と塗布 ⑥ケーブル，エアチューブの擦れの有無の確認 ⑦各関節の動作と原点位置のずれが無いかの確認

・コントローラ

①コントローラ内メモリバックアップ用バッテリの交換

【１次電源オンの状態で実施する作業】

①グリスの状態確認と給脂（サーボオフ時）

②運転時の異常振動と異音の確認（サーボオン時）

③教示点にズレがないかの確認（サーボオン時）

④ロボット位置検出器バックアップ用バッテリの交換（サーボオフ時）

（９）廃棄

①エンドエフェクタを取り外す

②ティーチペンダント等による誘導や手で押すなどして、固定冶具が取り付けられる位置や姿勢になるようにロボットを動かす

③固定冶具を取り付ける

④電源を切り、配線を外す

⑤クレーンを使用してロボットを運搬する場合は、付属のアイボルトを取り付ける

⑥ロボットとコントローラを廃棄場所へ運搬する

⑦各国法規が定めた方法で廃棄する

表1 制限仕様シート(続き)

.製品を使用する目的と用途（使用上の制限）	
2) 予見可能な 誤使用	・ロボットに過大な衝撃が加わる、ロボットにより過大な衝撃を加える作業での使用 ・ロボット、コントローラ、オプション品の改造、これらのカバーを外した状態での通電 ・指定された設置状態（床置き、天吊り、壁掛け）以外での運転 ・指定された強度に満たない架台等での運転 ・指定された設置条件以外での運転 ・運転中の動作信号待ちの停止を、運転停止だと思ってのロボットの危険範囲内への進入 ・仕様値を超えた条件での使用、または不適切な設定での使用 ・運転中およびサーボオン中の、電源オフによるロボットの停止 ・ボタンの押し間違えによる、意図しない運転 ・MANUAL モードでの動作確認を行わない運転 ・ロボットおよびハンド固定用ボルトの締結確認を行わない運転 ・誤配線による意図しない動作 ・プログラム選択間違いによる意図しない動作 ・ロボットに乗ったり、寄り掛かったり、アームにぶら下がる
3) 予期しない 起動	・過大なノイズによる誤作動 ・予期せず周辺機器からロボットに送られた起動信号による、ロボットの起動 ・異常な通信データによる、意図しない起動 ・電圧変動による誤作動 ・停電後の通電による電源オン ・故障などによる誤作動

表2 制限仕様シート

2.製品コンポーネントの交換等（時間上の制限）	
1) 機械的制限	・ロボットの運転前には、5 分間の低速（最大速度の 20%以下）運転を実施する ・日常点検,定期点検（3 ヶ月，6 ヶ月，1 年毎）,オーバーホール（5 年毎）により、
2) 電気的制限	適時または定期的に消耗品を交換する

表 3　制限仕様シート

3.製品の可動範囲等（空間上の制限）		
1) 動作範囲	第 1 軸 第 2 軸 第 3 軸 第 4 軸 付加軸 − −	ロボットマニュアルまたは据付・輸送編の仕様表による 個別の仕様による − −
2) インターフェース	輸送：梱包箱が、輸送作業者により運搬可能なこと 開梱：梱包箱が搬入可能なこと 　　　最低限、２m³ のスペースを確保すること 運搬：ロボットをクレーンで吊上げることが可能なこと 　　　二人以上で持ち上げて、台車等に載せることが可能なこと 　　　開梱場所から設置場所への経路に障害物がないこと 据付：ロボットの外形、動作範囲に適した場所に設置されていること 　　　コントローラの外形、通風に適した場所に設置されていること 　　　ケーブルは、作業者に踏まれない場所に設置されていること 教示：ロボット危険領域の外から教示作業が可能なこと 　　　危険領域に進入する場合、ロボットと周辺機器に挟まれない空間があること 運転：柵や囲いを設ける等により、ロボットの危険領域に誰も近づけないこと 　　　ロボット危険領域の外から、運転操作が可能なこと 　　　運転操作場所から、柵や囲い等の中に居る作業者が見えること 再梱包：ハンドの取外し、固定治具の組付け、ロボットとコントローラの分離、 　　　　ロボットやコントローラの架台からの取外しの作業が可能なこと 　　　　据付場所から梱包場所への移動が可能なこと 　　　　再梱包の作業が可能なこと 　　　　フォークリフト等で梱包箱を持ち上げることが可能なこと 保守：保守作業に必要な空間が確保されていること 　　　ロボット危険領域の外から、保守後の運転確認作業が可能なこと 　　　危険領域の中で、ロボットと周辺機器とに挟まれない空間があること 廃棄：ハンドの取外し,固定治具の組付け,ロボットとコントローラの分離, 　　　　ロボットやコントローラの架台からの取外しの作業が可能なこと 　　　　据付場所から廃棄場所へ移動が可能なこと	

表 3　制限仕様シート(続き)

3.製品の可動範囲等（空間上の制限）	
3) 作業環境	・ロボット危険領域を囲う柵や囲い等が用意され、運転中は誰も進入できないこと ・ロボットの運転状態を示す表示が用意され、運転中や停止中が分かること ・作業者を目視確認することができる照明が用意されていること ・足を滑らさないように、床が油などで覆われていないこと ・注意力を損なうような騒音がないこと

表 4　制限仕様シート

4.製品のライフサイクル
組立、出荷試験、輸送、開梱、運搬、据付、教示、運転、再梱包、保守、廃棄のライフサイクルの中で、ここでは、「運搬と設置」（輸送、開梱、運搬、据付、再梱包）、「使用」（教示、運転、保守）、「廃棄」のライフサイクルにおけるリスクアセスメントを実施

表 5　制限仕様シート

5.機械に接近する人		
対象者		知識・条件
1) 輸送作業者	知識	取扱説明書の内容
	条件	各国が法令で定めたフォークリフト等の運搬機器作業の教育等を受け、事業主が作業を許可した者
2) 開梱作業者	知識	取扱説明書の内容
	条件	－
3) 運搬作業者	知識	取扱説明書の内容
	条件	クレーンを使用する場合、各国が法令で定めたクレーン作業の教育等を受け、事業主が作業を許可した者
4) 据付作業者	知識	取扱説明書の内容、対象ロボットの操作方法
	条件	ロボットを誘導する場合、各国が法令で定めたロボット教示作業の教育等を受け、事業主が作業を許可した者
5) 教示作業者 作業監視者	知識	取扱説明書の内容、対象ロボットの操作方法、作業規定、ロボットの運転動作
	条件	各国が法令で定めたロボット教示作業の教育等を受け、事業主が作業を許可した者
6) 運転作業者	知識	取扱説明書の内容、対象ロボットの操作方法、作業規定、ロボットの運転動作
	条件	－
7) 再梱包作業者	知識	取扱説明書の内容、対象ロボットの操作方法
	条件	クレーンを使用する場合、各国が法令で定めたクレーン作業の教育等を受け、事業主が作業を許可した者 ロボットを誘導する場合、各国が法令で定めたロボット教示作業の教育等を受け、事業主が作業を許可した者

表 5　制限仕様シート(続き)

5.機械に接近する人		
対象者	知識・条件	
8) 保守作業者 作業監視者	知識	取扱説明書の内容、対象ロボットの操作方法、作業規定、ロボットの運転動作 対象ロボットの保守方法
	条件	各国が法令で定めたロボット検査作業の教育等を受け、事業主が作業を許可した者
9) 廃棄作業者	知識	取扱説明書の内容、対象ロボットの操作方法、廃棄物の処理方法
	条件	クレーンを使用する場合、各国が法令で定めたクレーン作業の教育等を受け、 事業主が作業を許可した者 ロボットを誘導する場合、各国が法令で定めたロボット教示作業の教育等を受け、 事業主が作業を許可した者
10) 付近の通行者 他の作業者	・ロボットの危険領域を囲う柵や囲い等の中に進入できない措置を施すこと ・危険領域に近づくと、ロボットが運転を停止する措置を施すこと ・ロボット危険領域の中に入って作業をする場合、ロボットの運転を停止して、駆動源 　を切り、教示作業者または保守作業者による監視下で、安全を確保すること	

表 6　制限仕様シート

6.その他

保証について

本製品は弊社が厳密な試験や検査を行い、性能が弊社規格を満足していることを確認してお届けしております。

万一不都合が生じた場合は、以下のように保証いたします。

1.保証期間

　　本製品の保証期間は以下のうち、いずれか先に経過した期間といたします。

　　（1）弊社工場出荷後 18 ヶ月

　　（2）お客様据付後 12 ヶ月

2.保証内容

　　（1）保証対象製品は、本製品です。また、保証範囲は、本製品の仕様書、カタログ、取扱説明書等により定めた仕様および機能といたします。本製品の故障が原因で発生した二次的・付随的損害はいかなる場合でも保証いたしかねます。

　　（2）本製品の保証期間内において、本製品に付属されている取扱説明書通りのお取扱い・ご使用にて発生した故障に限り、弊社は無償修理を行います。

　　　　保証期間経過後の故障修理はすべて有償とさせていただきますのでご了承ください。

3.免責事項

　　次の事項に該当する場合は、保証範囲から除外いたします。

　　（1）取扱説明書と異なったご使用、およびご使用上の不注意による故障、ならびに損傷

　　（2）経時変化あるいは使用損耗での不都合（塗装等の自然退色、消耗部品[1] の劣化など）

　　（3）感覚的現象での不都合（機能上影響のない発生音等）

　　（4）弊社によって認められていない改造、または分解が行われた場合

　　（5）保守点検上の不備、不適当な修理による故障、ならびに損傷

　　（6）天災・火災・その他外部要因による故障、ならびに損傷

　　（7）お客様が作成および変更されたプログラム、ポイントなどの内部データ

　　（8）日本国内で購入された本製品を国外へ持ち出した場合

1）　消耗部品とは、対象となるコントローラマニュアルに記載されている保守交換部品を指します。

4.ご注意

　　（1）本製品の仕様を超えてご使用になった場合、弊社は本製品の基本性能を保証いたしかねます。

　　（2）万一、取扱説明書に掲げた「危険」、「警告」、「注意」、「注記」をお守りにならなかった場合、人身事故・損害事故・故障などが起きましても、弊社は責任を負いかねます。

　　（3）取扱説明書の「危険」、「警告」、「注意」、「注記」およびその他記載事項は弊社の想定し得る範囲内のものであることをご了承ください。

産業用ロボットの安全に関する主な規格と法令について

国際工業規格 ISO/DIS12100「機械類の安全性」において、機械装置のリスク低減方策が規定されています。

ステップ１：本質的安全設計方策...力，速度，エネルギーの制限など
ステップ２：安全防護...安全柵の設置など
付加保護方策...非常停止装置の設置など
ステップ３：使用上の情報...警告標識，警報，取扱説明書など

これに基づいて、国際規格 ISO/IEC では各種規格を階層構造で分類した「ガイド 51」と呼ばれるものが定義されています。
産業用ロボットの安全規格は、階層Ｃの個別機械安全規格にて規格化されています。
●ISO 10218，ISO 10218-1

規格や法令については、産業用ロボットを使用する各国で定められたものに、必ず従ってください。

日本国内における産業用ロボットの主な規格と法令は、次の通りとなります。

産業用ロボットの安全規格は、日本工業規格（JIS）において、ISO 10218，ISO 10218-1 の技術的内容や構成を変更することなく、規格化されています。
●JIS B 8433，JIS B 8433-1

産業用ロボットの安全に関する日本国内の法令は、次のように定められています。
●労働安全衛生法...第５９条（安全衛生教育）
『事業者は、危険または有害な業務に従事する労働者に対し、安全または衛生の為の特別な教育を行わなければならない。』

産業用ロボットを扱う上で、特別な教育が必要である業務は、次のように定められています。
●労働安全衛生規則...第３６条（特別教育を必要とする業務）
・第３１号...産業用ロボットの教示等の業務
・第３２号...産業用ロボットの検査等の業務

産業用ロボットを扱う業務での危険を防止する為に取るべき措置は、次のように定められています。
●労働安全衛生規則...第９節（産業用ロボット）
・第１５０条の３...教示等
・第１５０条の４...運転中の危険の防止
・第１５０条の５...検査等
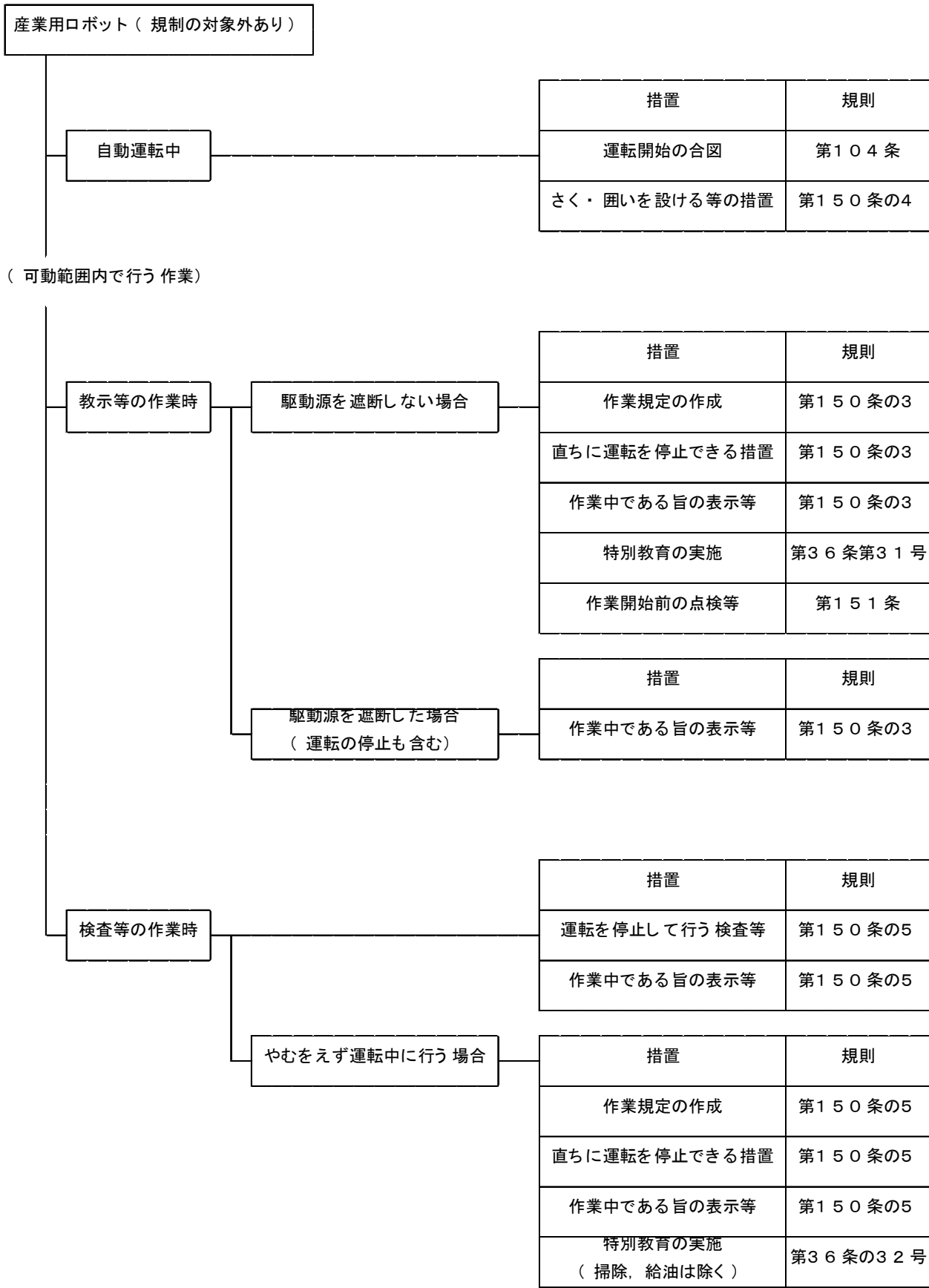・第１５１条　　 ...点検

残留リスク情報の提供は、『機械に関する危険性等をその機械の譲渡または貸与を受ける相手方事業者に通知すること』が、法令により努力義務として定められています。
●労働安全衛生規則…第２４条の１３（機械に関する危険性等の通知）
●上記第２項に基づき定められた、機械譲渡者等が行う機械に関する危険性等の通知の促進に関する指針

残留リスク情報の提供は、『機械に関する危険性等をその機械の譲渡または貸与を受ける相手方事業者に通知すること』が、法令により努力義務として定められています。

産業用ロボット（ 規制の対象外あり）

自動運転中

措置	規則
運転開始の合図	第１０４条
さく・ 囲いを設ける等の措置	第１５０条の4

（ 可動範囲内で行う 作業）

教示等の作業時 ── 駆動源を遮断しない場合

措置	規則
作業規定の作成	第１５０条の3
直ちに運転を停止できる措置	第１５０条の3
作業中である旨の表示等	第１５０条の3
特別教育の実施	第３６条第３１号
作業開始前の点検等	第１５１条

駆動源を遮断した場合
（ 運転の停止も含む）

措置	規則
作業中である旨の表示等	第１５０条の3

検査等の作業時

措置	規則
運転を停止して行う 検査等	第１５０条の5
作業中である旨の表示等	第１５０条の5

やむをえず運転中に行う 場合

措置	規則
作業規定の作成	第１５０条の5
直ちに運転を停止できる措置	第１５０条の5
作業中である旨の表示等	第１５０条の5
特別教育の実施（ 掃除， 給油は除く）	第３６条の３２号

労働安全衛生規則の体系図

安全上のご注意

コントローラ本体の取扱説明書には、お使いになる方や他の人への危害と財産の損害を未然に防ぎ、安全に正しくお使いいただくために、重要な内容を記載しています。

次の内容（表示・図記号）をよく理解してから本文をお読みになり、記載事項をお守りください。

[表 示 の 説 明]

表示	表示の意味
⚠危険	「誤った取扱いをすると人が死亡する、または重傷を負う危険性が切迫していること」を示します。
⚠警告	「誤った取扱いをすると人が死亡する、または重傷を負う恐れのあること」を示します。
⚠注意	「誤った取扱いをすると人が傷害[1]を負う恐れのあること」を示します。
注記	「物的損害[2]のみが発生する恐れが想定されること」を示します。作業を進める上でのアドバイスを示します。

1) 傷害とは、治療に入院や長期の通院を要さない、けが・やけど・感電などをさします。
2) 物的損害とは、財産・資材の破損にかかわる拡大損害をさします。

⚠危険
●コントローラの輸送から廃棄までを安全に行うために、対象となるコントローラマニュアルに記載されている安全マニュアルを必ず熟読してください。マニュアルの記載事項と異なる操作を行うと人に危害が加わります。

サービスネットワーク

本ロボットに関する技術的なお問い合わせは、弊社最寄りの営業所までご連絡ください。

また、ロボットに関するサービス、不具合対応、修理および定期保守は、東栄電機株式会社が担当しています。お客様のご要望に応じて保守契約を結び、定期点検、保守のサービスを行っています。

東栄電機株式会社＞＞＞サービス窓口

＜本社＞ エンジニアリング部サービス課 受付時間：8:00〜16:45	〒４１１－８５１０ 静岡県三島市松本１３１ ＴＥＬ（０５５）９７７－０１２５ ＦＡＸ（０５５）９７７－３７４４
＜東日本地区＞ エンジニアリング部サービス課 北関東サービスステーション 受付時間：8:30〜17:15	〒３３３－０８４７ 埼玉県川口市芝中田２－９－１２ ＴＥＬ（０４８）４９４－０６５９ ＦＡＸ（０４８）４９４－１７８４
＜西日本地区＞ エンジニアリング部サービス課 関西サービスステーション 受付時間：8:30〜17:15	〒５３６－０００８ 大阪府大阪市城東区関目１－１０－７ ＴＥＬ（０６）７６５１－４３８５ ＦＡＸ（０６）７６５１－４９１９

＞＞＞24 時間受付コールセンター

受付は 365 日対応

東栄電機株式会社	
フリーダイヤル（０８００）１１１－０１２５ ＦＡＸ（０５５）９７７－３７４４ メールアドレス　tecs@toei-electric.co.jp	QRコードはこちらです tecs@toei-electric.co.jp

基本編

TP5100 の操作における基本的な事項について説明します。

1. TP5100 について

1.1 TP5100 外形図

イネーブルスイッチ

非常停止スイッチ

液晶パネル

操作キー
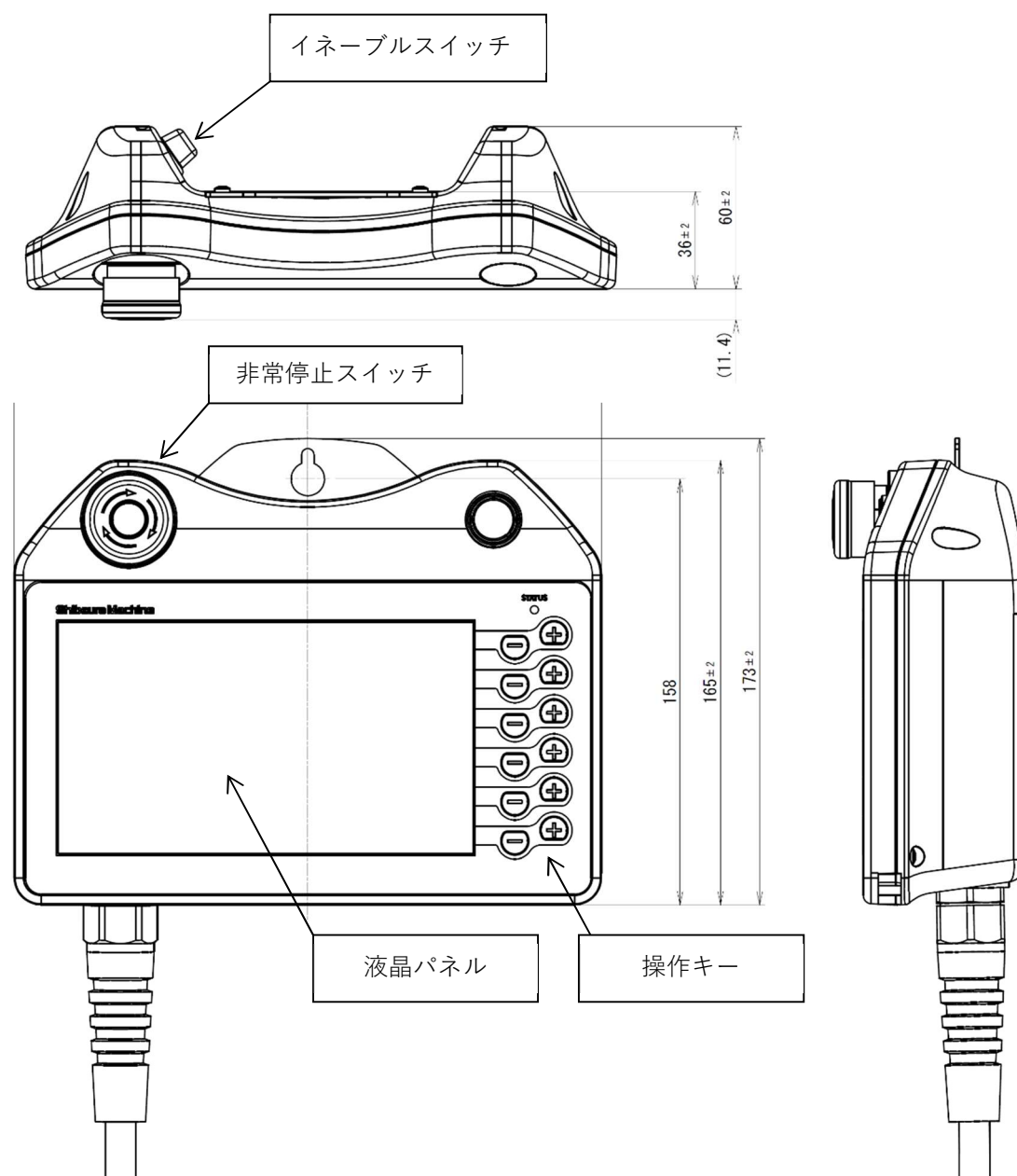
1.2 TP5100 仕様

No.	項　　目	仕　　　様	備　　考
1	使用周囲温度	0～40℃	
2	保存周囲温度	-20～60℃	
3	使用周囲湿度	10～90%RH(結露しないこと、湿球温度 39℃以下)	
4	保存周囲湿度	10～90%RH(結露しないこと、湿球温度 39℃以下)	
5	耐気圧（使用高度）	800～1114hPa（1000m 以下）	
6	耐振動	JIS　B　3502、IEC61131-2 に準拠	
7	保護等級	IP65	
8	質量	800g 以下（装置接続ケーブル除く）	
9	外形寸法	218(W)×173(H)×60(D)mm	ケーブルおよびスイッチ等の突起物不含
10	ケーブル長	5m（標準）、10m、15m	TP5100-5：5m TP5100-10：10m TP5100-15：15m
11	ケーブル活線挿抜	可能	
12	寿命	TFT バックライト　50,000 時間 タッチパネル　指入力　1,000 万回	

> *MEMO*
> ・*TP5100 をコントローラの TP コネクタから引き抜くと、非常停止スイッチが押されているのと同じ状態になります。*

1.3 TP5100 対応コントローラ

対応コントローラは、KSL3000 シリーズとなります。

1.4 TP5100 の基本操作

TP5100 に対して行う操作の説明を記載します。

1.4.1 押下

操作キーを押す動作のことを示します。
本マニュアル内で"押下する"と記載されている操作は、指定の操作キーを押したときから有効となります。

1.4.2 操作キー

ティーチペンダント右側にある、物理操作キーのことを示します。
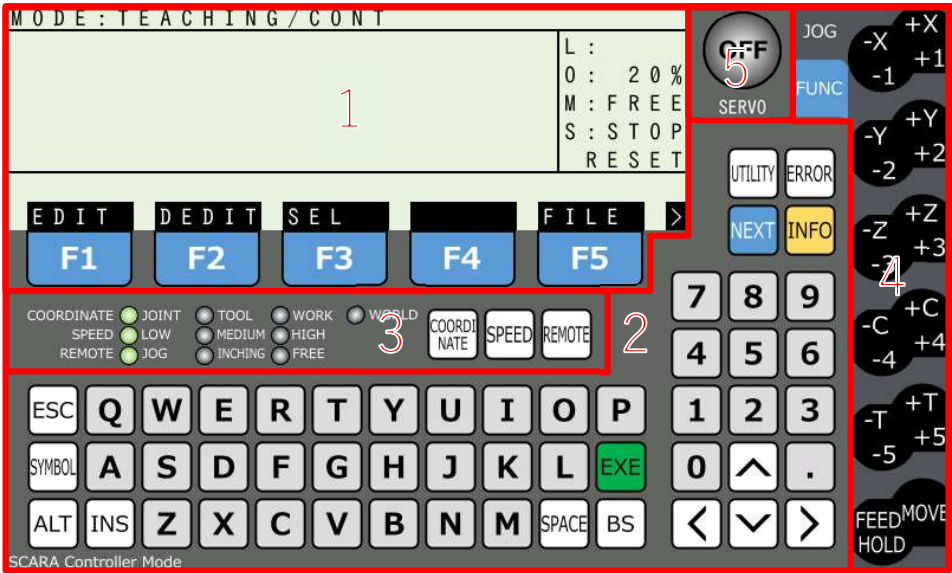画面に表示された操作キー表示を使用する場合は、こちらのスイッチを押下します。
詳細は、"1.4.4 操作キー表示"を参照してください。

1.5 TP5100 の画面レイアウト

TP5100 の画面レイアウトは以下のようになっています。
表示される画面は、接続されるコントローラ（ロボット）の種類によって自動的に切り替わります。

スカラシステム

図中番号要素の説明は以下の表を確認してください。

| 図中番号	名称	説明
1	メイン画面	ロボットの各種情報の表示や設定ができます。 ファンクションキー([F1]〜[F5])を押下することでの表示内容が 変わります。
2	キーボード	各キーを押下するとメイン画面で文字を入力します。 また UTILITY 等の特殊なキーについては、それぞれのキーに応じた動作 を行います。
3	ジョグ操作の ステータス表示	ロボットのジョグ操作時のステータスを表示します。 スカラシステムは[COORDINATE]、[SPEED]、[REMOTE]で、垂直多関節 システムは[JOG]押下後のメイン画面でステータスの切替えができます。
4	操作キー表示	操作キーを押下したときの動作を表示します。
5	サーボオンボタン	押下してサーボオンにするとこができます。

垂直多関節システム

垂直多関節システムはスカラシステムと以下の点が異なります。
・背景色（濃い青色）
・操作キー表示の表示内容

・[COORDINATE]、[SPEED]、[REMOTE]ではなく[JOG]がある
これら以外は、スカラシステムと同じです。
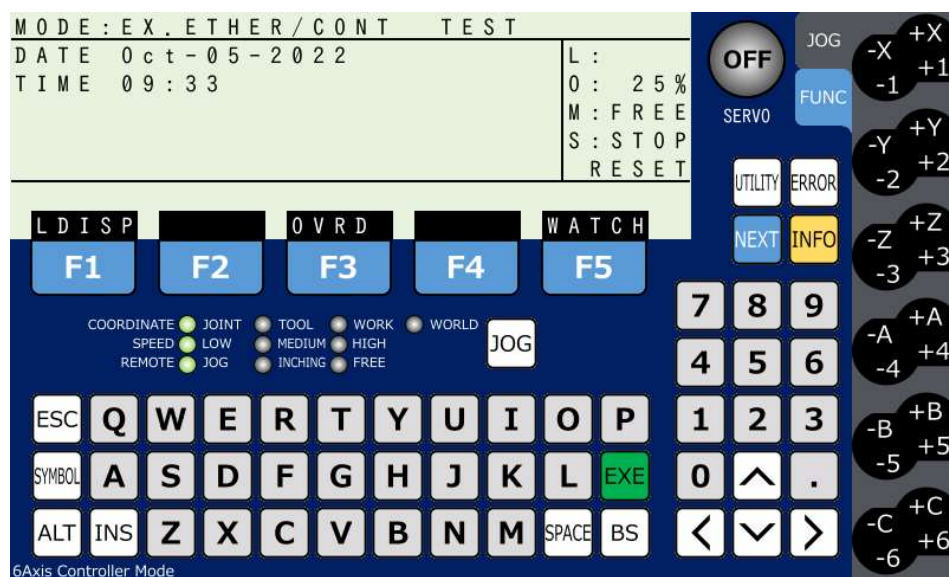
1.5.1 メイン画面

ロボットの各種情報の表示や設定、プログラム表示・編集ができます。
TP1000 と同様に、ファンクションキーを押下することでの表示内容が変わります。
ファンクションキーを押下したときの状態遷移・表示内容は、TP1000 と同じです。
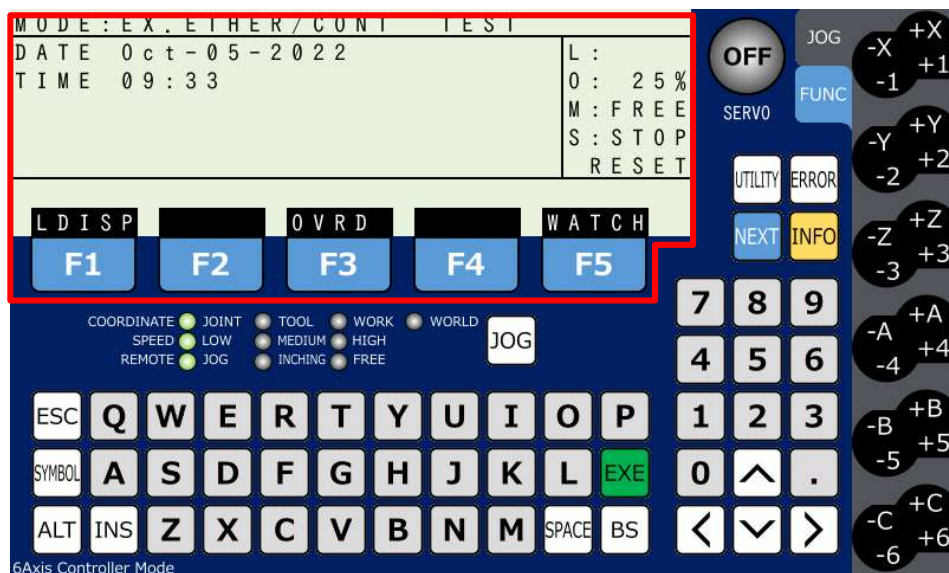
1.5.2 キーボード

ここでは、画面下部に表示されるキーボードと基本的なテキストの編集方法について説明します。
キーボードは常に画面下部に表示されます。
キーボードを使用して編集中のテキストボックスなどに文字や数字を入力することができます。

キーボード

[ALT]、[INS]、[SYMBOL]は、押すたびに有効／無効が切り替わり、有効時はオレンジ色になります。

[ALT]＋[キー]の操作では、[ALT]を有効にした後、他のキーを押下してください。

[ALT]を無効にするには、再度[ALT]を押下してください。

[INS]有効時は挿入モード、無効時は置換モードです。初期状態で[INS]は有効になっています。

[SYMBOL]有効時は、アルファベットのキー群が記号キー群に切り替わります。

	無効時	有効時
[ALT]	ALT	ALT
[INS]	INS	INS
[SYMBOL] と キーボード 表示		

＜キーボード操作例＞　[ALT]＋[↓]：次のページへの切替え

1. [ALT]キーを押下して、有効になった（キーの色が変わった）ことを確認します。
2. [↓]キーを押下します。
3. 次のページに切り替わります。

MEMO

・TP1000 にあった、[NUM/ALPHA]（数字とアルファベット表示を切り替える）はなくなりました。

・2 つ以上のキーを同時に押下することはできません。

特殊キー

キーボード以外のキーです。
操作内容は、[INFO]キー以外は TP1000 と同じです。

	キー	内容
[UTILITY]	UTILITY	TP1000 と同様、キーを押下するとユーティリティモードに切り替えます。外部入出力信号表示、現在位置表示、ワーク/ツール座標選択等ができます。
[ERROR]	ERROR	TP1000 と同様、押下すると現在検出中、またはリセットしていないエラーのコードと説明を表示します。
[NEXT]	NEXT	TP1000 と同様、次のページに切り替えます。
[INFO]	INFO	TP5100 のバージョン情報表示と画面キャリブレーションができます。詳細は、2.1 バージョン情報表示について と 2.3 画面キャリブレーションについて を参照してください。

1.5.3 ジョグ操作のステータス表示

ロボットのジョグ操作時の誘導タイプ、誘導座標、誘導速度の選択・表示をします。

これらのボタンを押下して選択します。
ロボットシステムによって表示されるキーが異なります。
垂直多関節システムでは、[JOG]を押下後、メイン画面に表示された画面より選択します。

	キー	内容	システム
[COORDINATE]	COORDINATE	JOINT(関節)、TOOL(ツール)、WORK(ワーク)、WORLD(ワールド)から選択します。	スカラシステムのみ
[SPEED]	SPEED	LOW(低/小)、MEDIUM(中)、HIGH(高/大)から選択します。	
[REMOTE]	REMOTE	JOG(ジョグ)、INCHING(インチング)、FREE(フリー)から選択します。	
[JOG]	JOG	JOG SETTING 画面を開きます。	垂直多関節システムのみ

[COORDINATE]、[SPEED]、[REMOTE]のボタンを押下するたびに、ステータス表示の左から順に遷移し、対応する LED が点灯します。

	表示	内容
COORDINATE	○ JOINT ○ TOOL ○ WORK ○ WORLD	座標の選択です。初期状態は JOINT です。

SPEED	○ LOW　　○ MEDIUM　○ HIGH	速度または移動量の選択です。 初期状態は JOG です。
REMOTE	○ JOG　　○ INCHING　○ FREE	モードの選択です。 初期状態は LOW です。

> *MEMO*
> ・*垂直多関節システムでは、[REMOTE]の"FREE"は選択できません。*

1.5.4 操作キー表示

　操作キー表示では、ディスプレイ右側に配置された操作キーを押下したときに実行する動作を表示します。

　＋キーを押下したときの動作を表示します

　－キーを押下したときの動作を表示します

タブの切替え

[JOG/FUNC]のタブは、押すたびに画面右端の操作キー表示が「JOG キー」と「ファンクションキー」に切り替わり、背景色も変化します。

JOG 選択時　　　　　　　　　　　　　　　　　FUNC 選択時
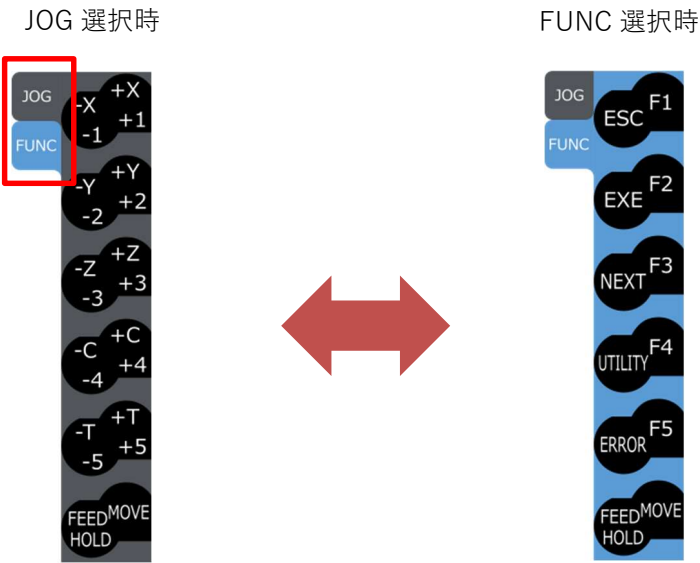
操作キー

スカラシステムと垂直多関節システムでは、表示されるキーや配置が異なります。

表示	操作キー押下時の動作
スカラシステム　　　垂直多関節システム 	操作キーを押下し続けている間、ロボットが関節軸または誘導座標(ワールド座標、ツール座標、ワーク座標)のキーに応じた軸方向に移動します。 垂直多関節システムでは、[FEED HOLD]と[MOVE]は本画面には表示されません。

表示	操作キー押下時の動作
	メイン画面に表示される[F1]～[F5]、キーボードの[ESC]キー、[EXE]キー、特殊キーの[NEXT]キー、[UTILITY]キー、[ERROR]キーを押下したときと同じ動作をします。
	[MOVE]キーを押下し続けている間、設定した目標位置に向かってロボットは PTP 動作を行います。
	[FEED HOLD]キーを押下すると、ロボットの動作およびプログラムの実行をホールドします。 ロボットの動作中に指令すると直ちに減速停止します。 FEED HOLD 中は、操作キー表示の色が変わります。

MEMO

・画面の操作キー表示の部分を押下しても、ロボットは動作しません。

1.5.5 サーボオンボタン

[SERVO]は、コントローラが TEACH モード時にイネーブルスイッチを押しながら**約 1 秒の長押し**でサーボオンします。
サーボオン中はランプが緑点灯になり、サーボ OFF 中は消灯します。

	サーボオン中	サーボオフ中
[SERVO]		

MEMO

・サーボオンボタンを押下しても、サーボオフはしません。

1.6 TP5100 の起動について

TP5100 とコントローラの接続方法、TP5100 の電源を入れるまでの操作方法について説明します。

1.6.1 TP5100 とコントローラを接続する

ティーチペンダント TP5100 のコネクタをコントローラの TP 差込口に接続してください。

（例）TSL3000
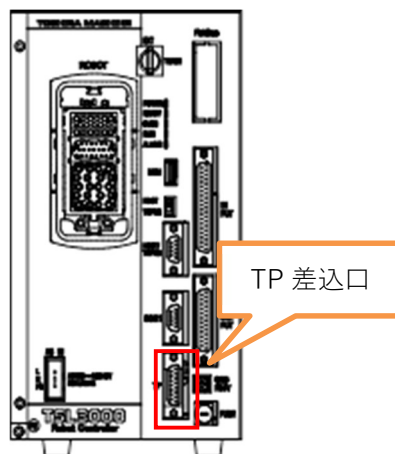
1.6.2 TP5100 を起動する

コントローラと接続した状態で、コントローラの電源を入れると TP5100 は自動的に立ち上がります。
内部でスカラシステム・垂直多関節システムを自動判別し、対応した画面を表示します。

TP5100 を起動すると、数秒黒い画面が表示されたのちトップ画面が表示されます。
起動後、以下のような画面が表示されます。

機能編

TP5100 で追加・変更された機能について説明します。

機能編
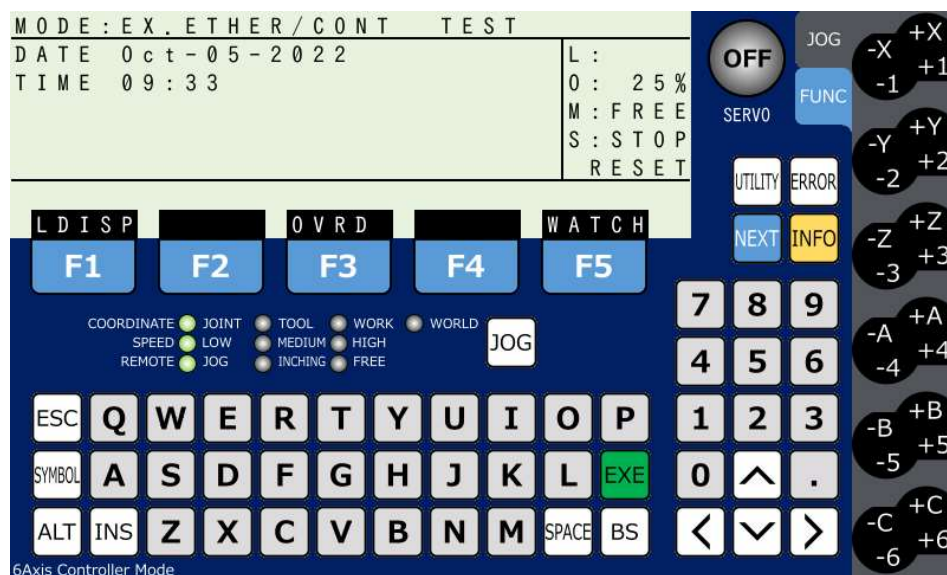
2. TP5100 の追加機能について

TP5100 で追加された機能について説明します。
既存の機能については、操作方法も変わりませんので"ST80720 TS3000 操作編"または"ST80730
TS3000 操作編（垂直多関節システム）"を参照してください。

2.1 バージョン情報表示について

本画面では TP5100 のバージョン情報表示及び画面キャリブレーションができます。
画面キャリブレーションについては、2.3 画面キャリブレーションについて　を参照してください。

＜バージョン情報画面の表示方法＞

1　[INFO]を押下します。

ポップアップウィンドウに TP5100 のバージョン情報が表示されます。

2　[OK]を押下するとポップアップウィンドウが閉じます。
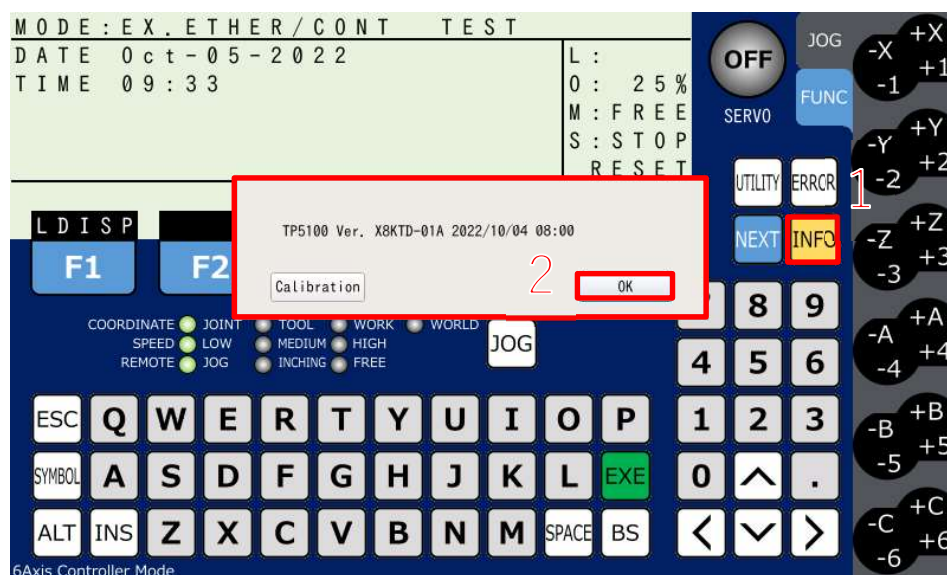
MEMO

・TP5100 のバージョンのみ表示されます。

コントローラのバージョンについては、[Utility] – [VER]で確認をしてください。

2.2 スクリーンセーバーについて

TP5100 には画面の焼き付き防止、バックライトの長寿命化のためにスクリーンセーバー機能があります。120 秒間操作しなかった場合、スクリーンセーバーが起動します。さらに一定時間経過後、バックライトが消灯します。
操作を行うとバックライトが点灯し、スクリーンセーバーが解除されます

> *MEMO*
>
> *操作とは、画面の押下、操作キーの押下、非常停止スイッチの操作、イネーブルスイッチのオン操作を指します。*

2.3 画面キャリブレーションについて

TP5100 の液晶パネルをタッチしたときに反応する位置の調整(画面キャリブレーション)を行うことができます。

＜画面キャリブレーション方法＞

1　[INFO]を押下してポップアップウィンドウが表示されたら、[Calibration]を押下します。
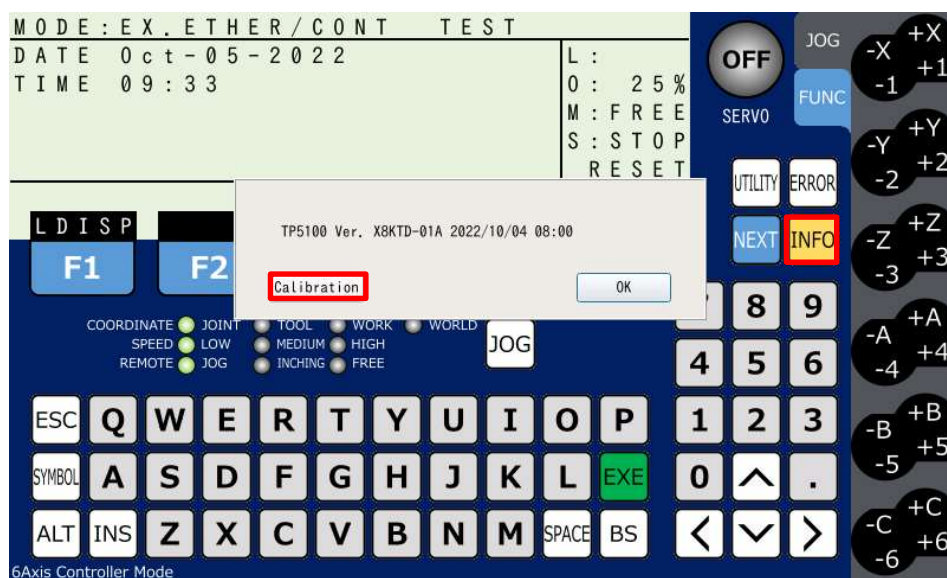
2 「画面キャリブレーションを実行しますか？」と表示されるので、[OK]を押下します。
  キャリブレーション用の画面が表示されます。

3 画面に表示される赤色のマークを 4 回押下します。
  マークを押下した位置をもとに押下位置の調整が行われます。
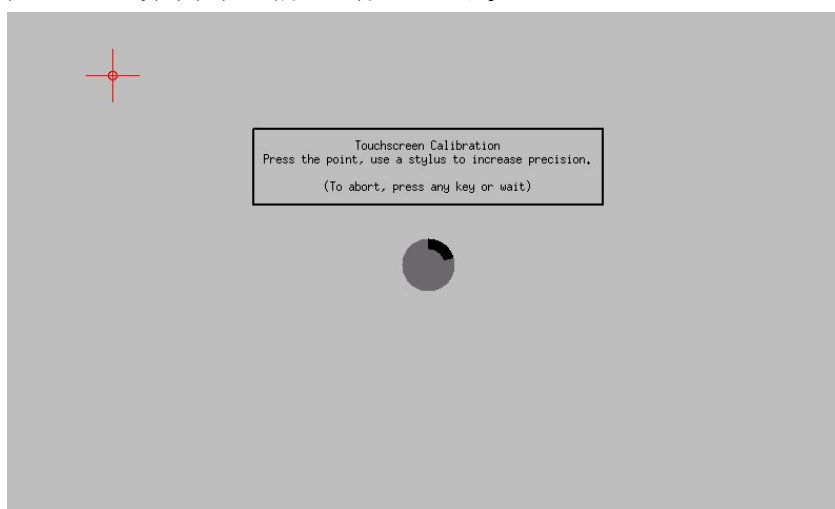
MEMO
・画面キャリブレーション用の画面で押下せずに一定時間経過すると、画面キャリブレーションが
キャンセルされ、元の画面に戻ります。

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